

GRADUATE BULLETIN

2024-25

This document contains a copy of the 2024-25 Penn State Graduate Bulletin as it appeared on May 6, 2024.

To view a current list of changes to the 2024-25 Graduate Bulletin since that date, please visit the [Changes to the Graduate Bulletin page](#).

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GRADUATE

This is the official Graduate Bulletin of The Pennsylvania State University.

The Graduate Council has responsibility for, and authority over, all academic information contained in the Graduate Bulletin.

Each step of the educational process, from admission through graduation, requires continual review and approval by University officials. The University, therefore, reserves the right to change the requirements and regulations contained in this Bulletin and to determine whether a student has satisfactorily met its requirements for admission or graduation, and to reject any applicant for any reason the University determines to be material to the applicant's qualifications to pursue higher education.

Archive

Past Bulletins

- 2022-23 Graduate Bulletin (<https://bulletins.psu.edu/archive/2022-2023/graduate/>)
- 2021-22 Graduate Bulletin (<https://bulletins.psu.edu/archive/2021-2022/graduate/>)
- 2020-21 Graduate Bulletin (<https://bulletins.psu.edu/archive/2020-2021/graduate/>)
- 2019-20 Graduate Bulletin (<https://bulletins.psu.edu/archive/2019-2020/graduate/>)
- 2018-19 Graduate Bulletin (<https://bulletins.psu.edu/archive/2018-19/graduate/>)
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- 2010-11 Graduate Bulletin (<https://bulletins.psu.edu/graduate/archive/graduate-2010-11.pdf>)
- 2009-10 Graduate Bulletin (<https://bulletins.psu.edu/graduate/archive/graduate-2009-10.pdf>)

Campuses

The Graduate School at Penn State is one of the largest in the nation with more than 14,000 graduate students enrolled at Penn State Erie, The Behrend College; Penn State Great Valley School of Graduate Professional Studies; Penn State Harrisburg, The Capital College; Penn State College of Medicine at the Penn State Hershey Medical Center; Penn State University Park; and Penn State World Campus.

Penn State Graduate Campuses Include: Erie

Penn State Erie, The Behrend College, gives undergraduate and graduate students the best of two worlds: the friendly, student-centered environment of a smaller college with the academic resources of a major research university. We offer an academically rigorous, globally respected Penn State education in a setting where students can have close interaction with faculty and meaningful out-of-classroom experiences. With more than 4,500 undergraduate and graduate students, 80-plus academic programs, and an inspiring 854-acre campus, Penn State Behrend is among the largest campuses in the Penn State system.

SEE ALL PROGRAMS OFFERED AT THE ERIE CAMPUS (https://bulletins.psu.edu/graduate-professional-programs/#filter=filter_9)

Great Valley

For over 60 years, Penn State Great Valley has been dedicated to providing high-quality educational programs to professionals in southeastern Pennsylvania. Located in Malvern, the campus offers graduate degrees and certificates in accounting, artificial intelligence, business, data analytics, engineering, finance, and leadership in addition to a variety of noncredit professional development programs. Evening and hybrid courses are held in a flexible, seven week format, allowing students to meet the demands of work, family, and life in general.

SEE ALL PROGRAMS OFFERED AT THE GREAT VALLEY CAMPUS (https://bulletins.psu.edu/graduate-professional-programs/#filter=filter_10)

Harrisburg

Penn State Harrisburg is an undergraduate college and graduate school of the University. The Harrisburg campus enrolls over 600 graduate students and offers more than 40 graduate programs, including master's and doctoral degrees and graduate and postbaccalaureate certificates. The college has nationally accredited programs, award-winning faculty who are accomplished teachers and scholars, and the resources of a world-class research university. Penn State Harrisburg is located on a suburban campus in Middletown, Pennsylvania, eight miles east of Harrisburg.

SEE ALL PROGRAMS OFFERED AT THE HARRISBURG CAMPUS (https://bulletins.psu.edu/graduate-professional-programs/#filter=filter_11)

Hershey

At Penn State College of Medicine we are committed to educating graduate students in basic medical sciences and others in public health-related professions. We seek to enroll students of exceptional quality, and provide them with a rigorous education and research environment allowing them to develop the skills necessary to be future leaders in their field.

Graduate Programs at the Penn State College of Medicine permit students to choose their dissertation adviser and committee members from the approximately 150 faculty members of the Program who represent more than 20 basic science and clinical departments. Research interests of Program faculty members are wide-ranging in both scientific disciplines and specific research interests. Graduate students benefit from the opportunity to tailor both their coursework and research to align closely with their particular interests. The objective of Graduate Programs at Penn State College of Medicine is to train individuals for advanced

professional careers in the Biomedical Sciences, Neuroscience, Anatomy, Public Health Sciences and related fields.

SEE ALL PROGRAMS OFFERED AT THE HERSHEY CAMPUS (https://bulletins.psu.edu/graduate-professional-programs/#filter=filter_12)

University Park

University Park is Penn State's largest campus, with a diverse graduate population of more than 5,000 master's and Ph.D. students.

SEE ALL PROGRAMS OFFERED AT THE UNIVERSITY PARK CAMPUS (https://bulletins.psu.edu/graduate-professional-programs/#filter=filter_13)

World Campus

Penn State World Campus is the online campus of Penn State. It enrolls more than 5,000 graduate students in degree and certificate programs offered by Penn State's academic units and colleges. World Campus offers its students a full array of services, including orientation, academic advising, career counseling resources, technical support, and tutorials.

SEE ALL PROGRAMS OFFERED AT THE WORLD CAMPUS (https://bulletins.psu.edu/graduate-professional-programs/#filter=filter_14)

Colleges and Enrollment Units

All graduate degree programs at Penn State are academically organized under one graduate college, The Graduate School, but with the graduate faculty located in, and graduate courses and graduate degree programs offered by the academic colleges that are generally organized around their subject matter. Some graduate programs may cross departments, colleges and even campuses, and such programs are called Intercollege Graduate Degree Programs, with many academically housed in the Graduate School and others housed in specific colleges or academic units. The colleges and enrollment units listed below offer graduate programs.

- Agricultural Sciences
- Arts and Architecture
- Donald P. Bellisario College of Communications
- Earth and Mineral Sciences
- Eberly College of Science
- Education
- Engineering
- Health and Human Development
- Information Sciences and Technology
- Intercollege
- International Affairs
- Liberal Arts
- Medicine
- Penn State Erie, The Behrend College
- Penn State Great Valley
- Penn State Harrisburg, The Capital College
- Ross and Carol Nese College of Nursing
- Smeal College of Business

Agricultural Sciences

About the College

László J. Kulcsár, Interim Dean, College of Agricultural Sciences

The College of Agricultural Sciences (CAS) was the first college established at Penn State and awarded the nation's first baccalaureate degrees in agriculture in 1861. Students can earn degrees related to animal and plant sciences; ecosystems and the environment; food and fuel; human and veterinary health and medicine; business, government, and nonprofits; teaching and extension; engineering; and more. The CAS is home to nine academic units with sixteen in residence and/or online graduate programs and participates in seven Intercollege Graduate Degree Programs (IGDP) and nine Dual-Title degree programs. The CAS has over 265 faculty with research appointments, over 520 enrolled graduate students and an average annual research expenditure of over \$115 million. Graduate students have received numerous fellowships and awards from both federal and state agencies and other private foundations. More than one-third of masters' degree recipients go into government or public-sector jobs, another third work in industry or private sector positions, and the remainder continue their graduate education. More than half of doctoral degree recipients go into academia, one-third enter industry or the private sector, and the remainder work in government or public-sector positions.

MORE INFORMATION ABOUT THE COLLEGE (<https://agsci.psu.edu/about/>)

Mission and Goals

The mission of Penn State's College of Agricultural Sciences is to discover, integrate, translate, and disseminate knowledge to enhance the food and agricultural system, natural resources and environmental stewardship, and economic and social well-being, thereby improving the lives of people in Pennsylvania, the nation, and the world.

The College will fulfill this mission by:

- Enhancing student success and optimizing enrollment
- Empowering the engines of discovery and application
- Creating dynamic, customer/stakeholder-focused educational products, services, and impacts
- Being a trusted source of information and provide collaborative solutions that balance agricultural productivity and sustainability
- Strengthening leadership, innovation, participation, and recognition within the College

MORE INFORMATION (<https://agsci.psu.edu/>)

Departments and Schools

Department of Agricultural and Biological Engineering

Founded in 1930, the Department of Agricultural and Biological Engineering in Penn State's Colleges of Agricultural Sciences and Engineering, provides high quality engineering education, research, and outreach. Our mission is to advance the engineering sciences, business, and technical management of biological and agricultural systems by promoting scholarship and engaging our students and stakeholders.

The Department of Agricultural and Biological Engineering offers two graduate programs: Agricultural and Biological Engineering and Bio Renewable Systems.

The Agricultural and Biological Engineering graduate program helps prepare students for careers involving the application of engineering principles to agricultural and biological production systems, processing systems, and conservation of land and water resources. The curriculum covers all areas of biological engineering, including development of machines for biological processing and agriculture, postharvest handling and processing of natural resource management and utilization, biological processes, food engineering, and structures and their environmental modifications.

The Bio Renewable Systems graduate program integrates science and technology with business (marketing, management, entrepreneurship, and leadership) for bio-based products/materials and their supply chains; provides an alternative high-quality graduate degree program for students without an engineering undergraduate degree; and prepares graduates to lead the development and advancement of the growing bio-based economy in key industry sectors: bio-based fuels, energy, chemicals, plastics, and packaging; pharmaceuticals; and cosmetics.

Department of Agricultural Economics, Sociology, and Education

The scholarship in AESE is related to people, society, and economic systems grounded in theory and methods from the social, behavioral and economic sciences. We develop and employ approaches to discover fundamental and applied principles that advance science and improve the health, prosperity and welfare of people in Pennsylvania and beyond.

The Department of Agricultural Economics, Sociology, and Education has four graduate programs: Energy, Environmental, and Food Economics; Rural Sociology; Education, Development and Community Engagement; and Community and Economic Development

The Energy, Environmental, and Food Economics (EEFE) is a unique intercollege graduate degree program providing state-of-the-art training in economics and quantitative methods as applied to the energy economics, policy and systems, natural resources and the environment, and food industrial organization.

The Rural Sociology program provides students with the highest quality educational and research experiences in rural sociology. Graduates of the program have gone on to launch highly successful careers in academe, in government, and in non-governmental research organizations.

The Education, Development, and Community Engagement (EDCE) program develops the capacity of people to be positive agents of change in their communities through applied research and comprehensive education, so that knowledge is translated into action. It prepares graduates for employment in college and university programs, non-formal education settings, state- and local-level administration, private industry, and international education.

The Community and Economic Development online program provides individuals with the knowledge and skills to work with citizens and leaders to establish and maintain viable communities and community organizations.

Department of Animal Science

The Department of Dairy and Animal Science originated in 1887, when Henry Armsby became director of the Agricultural Experiment Station. Today the department encompasses all food production animals and companion animals. We offer world-class teaching, research, and

extension programs in a variety of key areas in animal agriculture and the food system.

The Department of Animal Science has one graduate program that integrates all disciplines related to the function and care of animals with specializations in animal management, breeding and genomics, growth and development biology, meat science, nutrition, and nutritional, lactational and reproductive physiology.

Department of Ecosystem Science and Management

The Department of Ecosystem Science and Management is Pennsylvania's leader in preparing students for careers in sustainable management of natural resources. We conduct research to create new knowledge about forests, wildlife and fisheries, soils, and watersheds, and disseminate that knowledge through the classroom and extension education programs serving various stakeholders. The Department of Ecosystem Science and Management offers three graduate programs: Forest Resources, Soil Science, and Wildlife and Fisheries Science.

The Forest Resources program focuses on research, education, and scientific technology in the fields of forest resource management, forest biology, environmental concerns, and forest products.

The Soil Science program provides opportunities for candidates interested in soil and related water resources to become a professional leader and an independent scholar.

The Wildlife and Fisheries program focuses on habitat evaluation, ecology and management of game and nongame wildlife, animal damage control, urban wildlife, wildlife responses to altered ecosystems, conservation biology, fish systematics, fisheries management, ichthyology, fish behavior and ecology, freshwater ecology, aquaculture, landscape ecology, terrestrial and wetland ecosystems.

Department of Entomology

The diverse members of the Department of Entomology investigate fundamental and applied biological questions from the level of the molecule to population and community. The Department of Entomology offers one graduate program that is committed to conduct cutting-edge research in insect sciences with program themes like chemical ecology, ecological applications, disease biology and ecology, and pollinator biology and ecology.

Department of Food Science

The Department of Food Science at Penn State is one of the premier food science departments in the country. Our undergraduate food science major offers students hands-on science dealing with real-world applications; small, friendly atmosphere; world-class internship experiences; excellent scholarship opportunities, and near-100% job placement. The graduate program in the Department of Food Science delivers in-depth training in the core disciplines of food chemistry, food microbiology, food engineering and processing. There are also opportunities for students interested in nutrition education studies.

Department of Plant Pathology and Environmental Microbiology

The Department of Plant Pathology and Environmental Microbiology provides students with top-ranked educational and research opportunities in a collegial and friendly atmosphere. A major goal of our department is to support growth of healthy plants to beautify our living spaces, sustain our food supply, and maintain an inhabitable ecosystem. The Plant Pathology graduate program encompasses many diverse

and related sciences including microbiology, microbial ecology, plant disease epidemiology and management, molecular biology, genetics, and associated plant sciences.

Department of Plant Science

The Department of Plant Sciences encompasses horticulture, agronomy and crops and soils sciences. Our mission is to enhance our understanding and management of agronomic and horticultural crops and managed landscapes that are the foundation for managed ecosystems, food and fiber production, landscapes and environmental quality to enhance human environments. The Department of Plant Sciences offers one residential graduate program, Agricultural and Environmental Plant Science and one online program, Turfgrass Management.

The Agricultural and Environmental Plant Science program emphasizes research that increases the efficiency of production of agronomic and horticultural crops, improves the quality of food, feed, and fiber available for humans and animals, develops an understanding of the basic soil-plant-animal climate complex, and improves the overall quality of the human environment.

In the Turfgrass online graduate program students learn business concepts, personnel management theories, and how to manage the day-to-day challenges of running a turfgrass facility through the Master of Professional Studies (MPS) in Turfgrass Management.

Department of Veterinary and Biomedical Sciences

The Department of Veterinary and Biomedical Sciences at Penn State achieves excellence in research, teaching, and outreach in biomedical sciences and veterinary medicine. Our Department offers three undergraduate degrees at Penn State: Immunology and Infectious Disease, Toxicology, and Veterinary and Biomedical Sciences. The Department of Veterinary and Biomedical Sciences offers one graduate program in Pathobiology which seeks to understand the molecular basis of human and animal disease with a focus on immunology, microbiology, nutrition, biochemistry, virology, veterinary pathology, physiology, toxicology, and infectious disease.

Resources

Career Services and Experiential Learning

Students in the College of Agricultural Sciences are encouraged to seek out opportunities that will enrich their academic experience, outside of the classroom. The College of Agricultural Sciences offers programs and support for career readiness, including internship and job placement, undergraduate research opportunities, and professional growth and development.

Study Abroad

Where will your education take you? The college offers an array of international experiences aligned with your interests. Global experience broadens your horizons, giving you a deeper understanding of what you learn, prepares you professionally, and changes how you see the world. Visit our website for courses, programs, funding, and more!

The Office of International Programs offers many resources for graduate students interested in international research or study. Programs such as the Tag Along Fund provide opportunities for students to join their advisors on international trips. Students are also encouraged to submit proposals for travel related to individual research projects, which are considered on a case-by-case basis. Finally, the department houses

the INTAD Dual Title Degree program, which enables students to earn a degree in International Agriculture and Development (INTAD) concurrently with many majors offered by the College.

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Arts and Architecture

About the College

B. Stephen Carpenter II, Dean, College of Arts and Architecture

The College of Arts and Architecture at Penn State is a comprehensive arts community including academic programs in music, theatre, visual arts, art history, architecture, landscape architecture, and graphic design. The college is committed to artistic and scholarly creativity, research, and the preparation of specialized practitioners in all of the arts and design disciplines. As the administrative home of the Center for the Performing Arts, Palmer Museum of Art, Penn State Centre Stage, and Penn's Woods Music Festival, the college serves as a premier cultural destination in central Pennsylvania, offering numerous opportunities for community engagement along with its academic programs.

Research centers at both the academic unit and college level provide opportunities for graduate students to work closely with faculty and other scholars. The College of Arts and Architecture is proud of its close-knit community where students experience the best of both worlds—small class sizes, with all the resources of a Big 10 university. It is a dynamic and vibrant place, propelled by the energy and initiative of students like you.

MORE INFORMATION ABOUT THE COLLEGE (<https://arts.psu.edu/about/>)

Mission and Goals

The College of Arts and Architecture is committed to providing the highest quality training for artists, designers, scholars, teachers, and arts professionals, and to advancing research and creative activity in our disciplines. Our goals are to create transformative experiences for students; maximize visibility of the arts and design at Penn State; engage communities through research, curricula, and arts presentation; and lead in technology in the arts and design.

MORE INFORMATION (<https://artsandarchitecture.psu.edu/about/strategic-plan/>)

Accreditation

Our schools and programs are accredited by the top bodies in their fields, including the National Architectural Accrediting Board (NAAB),

the National Association of Schools of Art and Design (NASAD), the Landscape Architecture Accreditation Board (LAAB), National Association of Schools of Music (NASM), National Association of Schools of Theatre (NAST), National Council for Accreditation of Teacher Education (NCATE), and more.

Departments and Schools

Department of Art History

The Department of Art History offers lecture/discussion courses and seminars on a broad range of topics, from ancient to contemporary art and architecture in Europe, the Americas, Asia, Africa, and Oceania. Courses are also offered in museum studies, historiography, iconology, criticism, connoisseurship, and research methods. The department maintains a close relationship with the Palmer Museum of Art through courses in museum studies, assistantships, and other hands-on experiences for students. Graduate degrees offered include the M.A. and Ph.D.

MORE INFORMATION (<http://arthistory.psu.edu>)

School of Music

With approximately 325 students enrolled, the School of Music offers degrees that help develop students as performers, teachers, and scholars. The school hosts nearly 400 public events each year, providing students with ample opportunities to perform, from small chamber groups to large ensembles. Graduate degrees offered include the M.A. (musicology, music theory, and music theory/history), M.Mus. (composition/theory, conducting, performance, and pedagogy/performance), M.F.A. (voice pedagogy for musical theatre), D.M.A. (piano performance), and M.M.E. and Ph.D. (music education).

MORE INFORMATION (<http://music.psu.edu>)

H. Campbell and Eleanor R. Stuckeman School of Architecture and Landscape Architecture

The Stuckeman School is home to the departments of Architecture and Landscape Architecture, and the Graphic Design program.

MORE INFORMATION (<http://stuckeman.psu.edu>)

Department of Architecture

The architecture department offers focused opportunities for inquiry, research, and study in key areas of culture, space, and society; design computing; material matters; and sustainability. Graduate degrees offered include the M.S. and Ph.D. in architecture, dual-title M.S. and Ph.D. in architecture and human dimensions of natural resources and the environment (HDNRE), and the professional Master of Architecture.

MORE INFORMATION (<http://stuckeman.psu.edu/arch/>)

Department of Landscape Architecture

The landscape architecture program is consistently ranked among the best in the country. The department is guided by its bold mission: Great work grounded in commitment to environmental and social good. Degrees offered include the M.L.A. (Master of Landscape Architecture), M.S. in landscape architecture, and M.P.S. (Master of Professional Studies) and graduate certification in geodesign.

MORE INFORMATION (<http://stuckeman.psu.edu/larch/>)

Graphic Design

The graphic design program offers a close-knit community and individualized instruction through small class sizes. Graduates of the

graphic design program hold leadership positions in design studios, advertising agencies, and corporate in-house design offices throughout the United States and abroad. The M.F.A. degree is offered for graphic design students interested in pursuing a master's degree.

MORE INFORMATION (<http://stuckeman.psu.edu/gd/>)

School of Theatre

The School of Theatre offers undergraduate degrees in acting, musical theatre, design and technology, stage management, and theatre studies, and graduate degrees in design and technology, directing and music directing, and voice pedagogy. Students study, perform, and produce classics, musicals, and new and devised theatre works, while developing skills that will help them sustain full lives and careers in theatre. The school offers the M.F.A. in design and technology, directing for musical theatre, music directing for musical theatre, and voice pedagogy for musical theatre.

MORE INFORMATION (<http://theatre.psu.edu>)

School of Visual Arts

The School of Visual Arts (SoVA) offers degree programs in three areas of study: studio art, art education, and digital arts and design. SoVA's visual arts and design programs offer students opportunities to respond imaginatively to social and cultural change through exploration, expression, and communication in visual art and design forms. Graduate degrees include the M.F.A., M.P.S. (Master of Professional Studies) in art education, and M.S. and Ph.D. dual degrees in art education and women's, gender, and sexuality studies.

MORE INFORMATION (<http://sova.psu.edu>)

Resources

International Programs

International study goes hand-in-hand with study of the arts and design. The college is committed to providing international education opportunities. We work closely with Global Penn State to offer full semester and summer experiences all over the world.

MORE INFORMATION (<https://arts.psu.edu/students/>)

Multicultural Programs

The arts and design fields have always valued diversity and inclusion, and our college is no different. We are committed to developing and maintaining a student body, faculty, and staff that represent our diverse society. Learn more about how we create space where all individuals are valued on our college website.

MORE INFORMATION (<https://arts.psu.edu/students/>)

University and College Awards

We want the best possible student candidates from our college to be considered for college and University-level awards. There are a number of awards in research, service, leadership, and performance—a full listing is on our college website.

MORE INFORMATION (<https://arts.psu.edu/resources/scholarship-opportunities/>)

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Donald P. Bellisario College of Communications

About the College

Marie Hardin, Dean, Donald P. Bellisario College of Communications

The Donald P. Bellisario College of Communications provides the opportunities and resources of a large university with the personalized feel and support of a small school. As the largest accredited program of its kind in the nation, students can find numerous opportunities to fit in and succeed. The Bellisario College uses a proven approach to help students prepare for success. An emphasis on the combination of classroom instruction, campus media opportunities and career preparation represents the core of our educational philosophy. Faculty members blend strong academic and professional backgrounds and possess a commitment to excellence in teaching. In skills classes and internships, students use state-of-the-art technology to gain hands-on experience on their way to becoming the next generation of great digital storytellers.

The Donald P. Bellisario College of Communications offers an M.A. (Master of Arts) in media studies, a joint degree offering with Penn State Law (J.D./M.A.), an integrated B.A./M.A. in media studies, an M.P.S. (Master of Professional Studies) in strategic communications, and Ph.D. in mass communications. As graduate programs that use the resources of the entire Bellisario College, our curriculum allows students to design a program of study tailored to their interests, choosing from an array of classes each semester that explore theory and cutting-edge research methods in mass communication.

MORE INFORMATION ABOUT THE COLLEGE (<http://bellisario.psu.edu/about/>)

Mission and Goals

The mission of the Donald P. Bellisario College of Communications is to prepare students to take their place in an information-rich society and in the professions as active, critical and ethical participants. We promote effective, responsible use of communications media and technologies by individuals, organizations, industries and government.

Offering both a thesis and non-thesis option, the M.A. program prepares students for doctoral study in mass communications and for professional positions in business and government requiring a comprehensive understanding of the historical, social and political implications of the media in society and advanced research skills to critically evaluate the processes and effects of the media. Students graduating from this program will be especially well qualified to organize research projects, to

critically evaluate research reports and to directly influence mass media practices by the application of research findings.

For academically qualified students enrolled in a Bachelor of Arts program in the College of Communications, there is the opportunity to earn both the B.A. and the M.A. upon completion of five years of study. The Integrated Undergraduate-Graduate (I.U.G.) Program in Media Studies facilitates the advanced study of communications research and thesis development through a carefully organized selection of undergraduate courses, graduate seminars, and directed research projects. The program accelerates and enhances undergraduate students' appreciation for graduate level scholarship by involving them in the seminars, research activities, and the scholarly discourse of the college's community of master's- and doctoral-level scholars.

Penn State Law (PSL) and the Donald P. Bellisario College of Communications (COMM) offer a joint degree program leading to a Juris Doctor (J.D.) and a Master of Arts (M.A.) in Media Studies. In combining the J.D. in the School of Law with an M.A. in Media Studies, enrolled students would earn the two degrees in less time than taking them separately, and would integrate the credentials of the two degrees as well as the research skills and media-specific knowledge in the College of Communications with the legal expertise offered by a J.D. in the Penn State Law. The program will credential students who wish to pursue legal careers in media law or in areas of law in which media and/or communication industries are a significant component in a field related to legal aspects of the media and communications industries.

The online M.P.S. in Strategic Communications explores the importance of messaging. In this 30-credit degree program, you will learn the methods and practices used to conduct effective research in examining practical and theoretical questions in strategic communications. Course material in collecting, analyzing, and utilizing audience data for digital media are highlighted in this degree designed with the future of communications in mind.

The Ph.D. program in Mass Communications prepares graduates for entry into college and university teaching and research and for a variety of communications-related professions. Doctoral education in the Bellisario College of Communications is committee-driven and highly flexible and emphasizes the cultivation of research skills leading to the development and implementation of innovative and impactful research on mediated communication.

MORE INFORMATION (<http://bellisario.psu.edu/about/plans-reports/>)

Accreditation

The Donald P. Bellisario College of Communications is evaluated regularly by the Accrediting Council on Education in Journalism and Mass Communications and has consistently met the high standards of the Council. For undergraduate students, accreditation most practically means that most upper-level professional classes are small, the College uses the latest in technology, and provides outstanding student service.

MORE INFORMATION (<http://www.aejmc.org>)

Departments and Schools

The M.A., I.U.G., J.D./M.A. and Ph.D. in the Bellisario College of Communications draw from the faculty of all four departments. The M.P.S. in strategic communications is housed in the Department of Advertising and Public Relations

Department of Advertising/Public Relations

Faculty in this department research the effectiveness and social implications of strategic communication, from both quantitative and qualitative perspectives. The M.P.S. in strategic communications is housed in this department and faculty also contribute to the other graduate programs in the College.

MORE INFORMATION (<http://bellisario.psu.edu/adpr/>)

Department of Film-Video and Media Studies

Emphasizing social science-based media effects, critical-cultural perspectives, and film studies, faculty in this department focus their research on media's role in individual well-being, society and culture. Faculty in this program contribute to college level graduate degree programs.

MORE INFORMATION (<http://bellisario.psu.edu/fvms/>)

Department of Journalism

Journalism is a vital institution for a democracy. Faculty in this department study the historical, legal, professional and ethical implications of journalism. Journalism faculty contribute to all of the college level graduate degree programs the College offers.

MORE INFORMATION (<http://bellisario.psu.edu/journ/>)

Department of Telecommunications

Focusing on a variety of electronic media, including radio and TV, cable and satellite, the internet, and wired and mobile technologies, faculty in Telecommunications research such media from policy, economic, technological and managerial perspectives Faculty contribute to all college level graduate degree programs.

MORE INFORMATION (<https://www.bellisario.psu.edu/departments/telecommunications/>)

Resources

Research Centers

The Bellisario College of Communications houses several research centers that richly contribute to the graduate students' experience and offer support as students advance through their program of study. These centers include The John Curley Center for Sports Journalism, The Don Davis Program in Ethical Leadership, The Information Communication Technology for Development Consortium (ICT4D), The Institute for Information Policy, The Media Effects Research Lab, The Newspaper Journalists Oral History Program, The Arthur W. Page Center for Integrity in Public Communication, The Pennsylvania Center for the First Amendment, and The Science Communication Program.

Office of Academic Services

A dedicated, eight-person staff supports students through scheduled appointments, drop-in hours and a variety of support services. At the graduate level, typically I.U.G. student utilize this resource.

MORE INFORMATION (<http://bellisario.psu.edu/current/advising/>)

Office of Internships and Career Services

Graduate students are encouraged to use the resources provided by this office. The office conducts two job fairs and offers additional support through resume workshops, mock interviews and "career conversations" with alumni who return to campus.

MORE INFORMATION (<http://bellisario.psu.edu/career-services-and-internships/>)

Office of Diversity and Inclusion

The Office of Diversity and Inclusion strives to make the Bellisario College a comfortable, welcoming home for all students, staff and faculty. This office assists in acclimating graduate students new to Penn State to navigate Penn State infrastructure, while also providing additional insight and perspective on the State College area. Professional and career guidance is also offered.

MORE INFORMATION ABOUT THE OFFICE OF DIVERSITY AND INCLUSION (<http://bellisario.psu.edu/current/diversity/>)

MORE INFORMATION ABOUT BELLISARIO COLLEGE ALUMNI (<http://bellisario.psu.edu/alumni/>)

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Earth and Mineral Sciences

About the College

Lee Kump, Dean, College of Earth and Mineral Sciences

For more than a century, Penn State's College of Earth and Mineral Sciences has been a beacon of intellectual leadership on issues of utmost importance to the welfare of the Commonwealth, the nation, and beyond. The college is creating tomorrow's leaders in Earth, energy, and materials sciences and engineering and plays an important role in preparing a diverse and talented workforce, as well as providing new knowledge that will drive the economic vitality of the state and the nation. With its top ranked programs and five academic departments, the college provides a comprehensive, high-quality education and is at the forefront of both innovative teaching and path-breaking research focused on meeting the needs of our global society.

Distinguished researchers and educators at the cutting edge of their disciplines are dedicated to supporting hands-on learning and research that provides each student with invaluable, experiential knowledge.

MORE INFORMATION ABOUT THE COLLEGE (<https://www.ems.psu.edu/about/>)

Mission and Goals

By building on its reputation for scientific leadership in the earth, energy, and materials sciences and engineering, the College of Earth and Mineral Sciences' mission is to develop new discoveries about how the Earth's systems interact with one another and with people and their institutions

and to use the knowledge gained from those discoveries to inspire students to become new generations of leaders.

MORE INFORMATION (<https://www.ems.psu.edu/about/who-we-are/mission-vision-and-strategic-plan/>)

Departments and Schools

John and Willie Leone Family Department of Energy and Mineral Engineering

The John and Willie Leone Family Department of Energy and Mineral Engineering offers academic programs addressing scientific, technological, business, and social challenges related to energy and earth resources and systems. The EME undergraduate B.S. majors address the effective production, conversion, use, and management of energy and mineral resources and include Energy Business and Finance (EBF), Energy Engineering (ENENG), Environmental Systems Engineering (ENVSE), Mining Engineering (MNGE), and Petroleum and Natural Gas Engineering (PNGE). The EME graduate program offers advanced degrees in Energy and Mineral Engineering (M.S. and Ph.D.) with research concentration options in energy system engineering (ESysE), fuel science (FSC), mining and mineral process engineering (MMPE), and petroleum and natural gas engineering (PNGE). The B.A. degree in Energy and Sustainability Policy (ESP) and graduate certificates and associated M.S. in Renewable Energy and Sustainability Systems (RESS) complement our programs by integrating areas of study in energy security, sustainability management, renewable energy, foreign and domestic energy and sustainability policy analysis. The EME graduate program also offers integrated undergraduate-graduate (IUG) degree programs that combine the M.S. in Energy and Mineral Engineering with each of the five B.S. degree programs.

MORE INFORMATION (<http://www.eme.psu.edu/>)

Department of Geography

The Department of Geography offers academic programs (M.S., M.G.I.S., Ph.D. in Geography) that conducts theoretical and applied research in all four major subfields of geography: human, physical, environment and society, and GIScience. Across these subfields we emphasize the geography of global change. Our perspectives span local to global levels across spatial and temporal scales. Addressing these components of global change, we also advance geographical information science and technology needed to use new spatial data generated from combinations of specialized sensors and the Internet of things. Research and specialization clusters include: Environmental Change and Prediction; Food Security and Human Health; Geospatial Big Data Analytics; Justice, Ethics, and Diversity; Population, Environment, and Governance; Spatial Modeling and Remote Sensing. The department also offers online certificate and master's degree programs in Geographic Information Systems (GIS), Remote Sensing and Earth Observation (RS), and Geospatial Intelligence (GEOINT).

MORE INFORMATION (<http://www.geog.psu.edu/>)

Department of Geosciences

The Department of Geosciences offers M.S. and Ph.D. degrees in geosciences, dual titles in Astrobiology and Biogeochemistry, and an M.Ed. in Earth sciences all designed to provide students with an integrated, interdisciplinary study of the whole Earth, afford them with the skills and knowledge needed to solve real-world problems, and prepare them for careers at the forefront of geosciences.

MORE INFORMATION (<http://www.geosc.psu.edu/>)

Department of Materials Science and Engineering

The Intercollege Graduate Degree Program in Materials Science and Engineering offers both M.S. and Ph.D. degrees in Materials Science and Engineering. Instruction covers both the fundamental science of materials and practical engineering applications. Students have the opportunity to learn in depth about one more families of materials, including biomaterials, ceramics, metals, nanomaterials, polymers, and semiconductors. There is also a doctoral minor in computational materials.

MORE INFORMATION (<http://www.matse.psu.edu/>)

Department of Meteorology and Atmospheric Science

The Department of Meteorology and Atmospheric Science offers academic programs (M.S., Ph.D. in Meteorology and Atmospheric Science; dual-title Ph.D. in Climate Science; dual-title Ph.D. in Astrobiology) that explore fundamental aspects of cloud physics, turbulence, numerical weather prediction, climate change, weather risk, atmospheric chemistry, atmospheric convection, and atmospheric dynamics on a range of scales using theory, observations, and numerical simulations.

MORE INFORMATION (<http://www.met.psu.edu/>)

Resources

Office of Educational Equity

Diversity among students and faculty is a top priority for the College of Earth and Mineral Sciences and the Office of Educational Equity takes an active role in promoting respect and embracing diversity and inclusion in the college.

MORE INFORMATION (<https://www.ems.psu.edu/undergraduate/beyond-classroom/diversity-programs/>)

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<https://www.ems.psu.edu/graduate> (<https://www.ems.psu.edu/graduate/>)

Eberly College of Science

About the College

Tracy Langkilde, Verne M. Willaman Dean, Eberly College of Science

The Eberly College of Science provides instruction and research opportunities in the biological, mathematical, physical and interdisciplinary sciences. The college offers undergraduates sixteen majors that lead to the B.S. degree, with several options, and Mathematics can lead to either the B.S. or B.A. degree. Fourteen minors for undergraduates that can broaden their learning are also offered. The college strives to provide students with the knowledge and experiences that will enable them to be scientifically-trained leaders and innovators

who advance the frontiers of science and make a difference in the world. Our faculty, staff, and students work together to learn, create, and apply knowledge in the basic sciences. Graduates of our programs use their strong foundation and critical thinking skills in a wide range of careers. Many graduates continue their education in graduate or professional schools, while others choose from a variety of careers in industry, government, or education.

MORE INFORMATION ABOUT THE COLLEGE (<http://science.psu.edu>)

Mission and Goals

The mission of the college is to improve society and address global challenges through excellence in science education and research. We train tomorrow's scientific leaders and innovators, and provide rich science education for all Penn State students. We enhance public understanding of science by sharing our knowledge and discoveries with the people of the Commonwealth, nation, and world. We make discoveries that expand fundamental knowledge in science, and are applied to solve real-world challenges.

MORE INFORMATION (<http://science.psu.edu/about/college-vision-mission-and-goals/>)

Departments and Schools

Department of Astronomy and Astrophysics

The Department of Astronomy & Astrophysics seeks to expand our knowledge of the universe through undergraduate and graduate education, research, and public outreach. Students are active and vital participants in the research programs conducted in the department, providing important training for progression into graduate education. In addition, with its depth and breadth in research opportunities, the department offers pathways to careers in research and teaching in astronomy and related fields. The Department is involved in a wide variety of observational, experimental, and theoretical projects that cover most active areas of astrophysical research. The Department also has an extensive program of public outreach that promotes science including public lectures, workshops, planetarium shows, and public open houses.

MORE INFORMATION (<http://astro.psu.edu/>)

Department of Biochemistry and Molecular Biology

The Department of Biochemistry and Molecular Biology (BMB) is enthusiastically engaged in basic research to probe fundamental principles of the behaviors of molecules and cells, the organization of biological systems, and promising applied research to identify scientific solutions to pressing problems in areas such as cancer, bacterial and viral pathogenesis, antibiotic resistance, and energy production. BMB is dedicated to educating the next generation of scientists, and is the departmental home to students from four undergraduate majors: Biochemistry and Molecular Biology, Microbiology, Biotechnology, and Forensic Science. BMB also trains Ph.D. students in the Biochemistry, Microbiology and Molecular Biology Program, and Master's degree programs in Biotechnology and Forensic Science.

MORE INFORMATION (<http://bmb.psu.edu/>)

Department of Biology

The Department of Biology is internationally recognized in teaching and research in the biological sciences. The research and instructional mission of the department spans ecology to molecular biology, and represents the most diverse program in the biological and life sciences at

Penn State. Over the past 35 years more than 6,000 students have earned bachelors degrees in Biology from Penn State, and over 400 graduate students have earned advanced degrees with Biology faculty members. Departmental students, faculty, and alumni contribute to the welfare of our society through their activities including education, public health and services, business, and basic and applied research.

MORE INFORMATION (<http://bio.psu.edu/undergraduate-portal/>)

Department of Chemistry

The Department of Chemistry is a leader in many significant areas of chemistry research and discovery, including materials chemistry, life sciences and nanoscience. The department has nationally acclaimed strengths in faculty research, graduate and undergraduate education. With a dedicated staff and state-of-the-art research support facilities, Penn State Chemistry is an excellent place to work, study or pursue your love of research. The department is dedicated to a core set of values: excellence in teaching and research, respect for all members of the Department and University, diversity in our students, faculty and staff, and service to the citizens of the world.

MORE INFORMATION (<http://chem.psu.edu/>)

Department of Mathematics

The Mathematics Department is a thriving research and teaching community of faculty, undergraduate and graduate students, and postdoctoral researchers. The department is committed to excellence in mathematics instruction for all Penn State undergraduates, and houses the Mathematics bachelors, masters, and doctoral degrees. The Department is housed in the McAllister Building on the University Park Campus, and it is one of the few in the nation with a physical laboratory where research and educational laboratory experiments are conducted.

MORE INFORMATION (<http://math.psu.edu/>)

Department of Physics

The Department of Physics is home to innovative scientists, inspiring teachers, creative students, and accomplished alumni making exciting discoveries at the frontiers of knowledge. According to a multi-year study released by the National Research Council (NRC) in 2010, the Department of Physics is in the top echelon of physics departments in the United States. Developments in science and technology move very fast, the undergraduate and graduate degrees in Physics provide the fundamental tools with which to attack the scientific and technological problems of the next millennium.

MORE INFORMATION (<http://www.phys.psu.edu/undergraduate/>)

Department of Statistics

The Department of Statistics is committed to teaching the theory and practice of statistics to undergraduate and graduate students and to conducting original research. Our world-renowned faculty are members of international collaborations making significant discoveries that will make life better throughout the world. Penn State Statistics has recently been ranked among the best programs in the nation according to the National Research Council.

MORE INFORMATION (<http://stat.psu.edu/>)

Premedical Professions Programs

The Premedical Professions Programs are the academic home for undergraduate students interested in pursuing professional careers in medicine and related health professions. The programs include the

undergraduate major Premedicine and the accelerated Premedicine-Medicine program. In addition, the program's advisers provide academic and career counseling for all students, regardless of their major, who wish to apply to medical schools and professional health programs.

PreMedical Medical Program

MORE INFORMATION (<http://science.psu.edu/premed/accelerated-programs/premedmed/>)

Premedical Program

MORE INFORMATION (<http://science.psu.edu/premed/>)

Science B.S. Programs

The Science B.S. Programs are the academic home for undergraduate students interested in pursuing broad, integrative studies in science. The program includes the general science major (Science B.S.) as well as the accelerated Science/MBA program for students interested in leadership positions in science and technology industries.

Science B.S. Program

MORE INFORMATION (<http://science.psu.edu/sciencebs/>)

Science B.S./M.B.A. Program

MORE INFORMATION (<http://science.psu.edu/bsmba/>)

Resources

Academic Advising

The goal of academic advising in the college is to assist with students' transition to college, and provide guidance that will lead to being a successful science student. We provide assistance with policies and procedures, courses, academic programs, and requirements related to our majors and career goals.

MORE INFORMATION (<http://science.psu.edu/current-students/support-network/find-your-academic-adviser/>)

Health Professions Advising

This office provides health professions advising to any Penn State student, enrolled in any college, who is interested in medicine and allied health professions, including podiatry, dentistry, optometry, pharmacy, physician assistant, and others.

MORE INFORMATION (<http://science.psu.edu/premed/advising/>)

Center for Excellence in Science Education

The Center for Excellence in Science Education (CESE) in the Eberly College of Science provides faculty and students with a collaborative educational network that promotes excellence in science teaching and learning. #CESE offers a variety of evidence-based teaching workshops and other activities for faculty professional development as well as learning skills workshops for student academic development. #It also houses the Eberly College of Science Learning Assistant (LA) Program that offers over 700 undergraduate peer teaching positions each academic year.

MORE INFORMATION (<http://cese.science.psu.edu/>)

Office of Science Engagement

The Office of Science Engagement connects students with opportunities to enhance and extend their learning in co-curricular experiences such as research and educational abroad. We also offer career counseling and

development for students, emphasize academic and professional growth, and offer a range of resources to support students' success.

MORE INFORMATION (<http://scienceengagement.psu.edu/>)

Contact

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EBERLY COLLEGE OF SCIENCE

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<http://science.psu.edu>

Education

About the College

Kimberly A. Lawless, Dean, College of Education

The Penn State College of Education offers you unique experiences that can be found only here. As a student, you get a solid foundation from your courses. But that's not all. You are surrounded by a support system of faculty members, advisers, and more who will help you succeed. You can be involved in multiple educational experiences on and off campus, from across the street to across the globe. You'll discover new cultures and innovative ideas while at Penn State. Soon enough, those new ideas will be coming from you. It is going to be an invaluable chapter in your life.

MORE INFORMATION ABOUT THE COLLEGE (<https://ed.psu.edu/>)

Mission and Goals

The mission of the College of Education at Penn State is to deepen and extend knowledge about the formation and utilization of human capabilities. This broad and exciting mission permits us to focus on teaching and learning in many different content areas and with learners of many different ages, ranging from early childhood to adults. Our interest in the utilization of human capabilities connects us with many fields such as rehabilitation and human services and workforce education and development.

MORE INFORMATION (<https://ed.psu.edu/about/vision-and-mission/>)

Accreditation

The College of Education educator preparation programs are fully accredited at the Initial and Advanced levels by the Council for the Accreditation of Educator Preparation (CAEP). The next CAEP program

review will be Fall 2026. CAEP advances excellence in educator preparation through evidence-based accreditation that assures quality and supports continuous improvement to strengthen P-12 student learning.

MORE INFORMATION (<https://ed.psu.edu/about/accreditations/>)

Departments and Schools

Department of Curriculum and Instruction

The Department of Curriculum and Instruction (CI) at Penn State offers undergraduate and graduate degrees and many options for teacher certification. There is a growing demand for graduates of teacher education programs. This department offers professional programs leading to certification in early childhood (PK-4), middle-level education (grades 4-8), and in a variety of discipline areas leading to certification at the secondary-school level.

MORE INFORMATION (<https://ed.psu.edu/academics/departments/department-curriculum-and-instruction/>)

Department of Education Policy Studies

The Education and Public Policy program gives undergraduates a comprehensive understanding of the challenges and opportunities in education today. A robust community of students have access to online programs wherever they happen to reside, guided by the same faculty and the same curriculum as in-person students find at University Park.

MORE INFORMATION (<https://ed.psu.edu/academics/departments/department-education-policy-studies/>)

Department of Education Psychology, Counseling, and Special Education

The EPCSE programs aim to help you prepare to work as school counselors, clinical mental health counselors, school psychologists, and special education educators as well as faculty in higher education institutions.

MORE INFORMATION (<https://ed.psu.edu/academics/departments/department-educational-psychology-counseling-and-special-education/>)

Department of Learning and Performance Systems

MORE INFORMATION (<https://ed.psu.edu/academics/departments/department-learning-and-performance-systems/>)

Contact

Rayne A. Sperling

Associate Dean, Undergraduate and Graduate Studies
College of Education
Penn State University
278 Chambers Building
University Park, PA 16802-3206
814-865-2524
Fax: 814-865-0555

<https://ed.psu.edu/>

Engineering

About the College

Tonya L. Peeples, Harold and Inge Marcus Dean of Engineering

The Penn State College of Engineering has grown over its 125-plus-year history into the largest college at the University and one of the largest engineering colleges in the nation, ranked among the best for education and research and united in the common purpose of inspiring change and impacting tomorrow.

The college is strategically focused on growing a pervasive, welcoming, and inclusive culture and climate. Engineering graduate students are part of a community that is created and sustained by individuals from all backgrounds around the world, each bringing their own unique perspectives, experiences, and passions.

Committed to helping students engineer what's next, the college delivers more than 40 programs that span 20-plus engineering disciplines, with multiple program types and delivery formats.

Master of science and doctoral offerings prepare students for research-focused roles in academia, industry, government, and other sectors. Graduate students in these programs are integral to an engineering research enterprise with more than \$140 million in annual expenditures. Residential and online master and doctor of engineering programs along with graduate certificate offerings help graduate students gain technical and professional skills to enhance marketability to employers and accelerate career growth as part of a global engineering alumni network.

MORE INFORMATION ABOUT THE COLLEGE (<http://www.engr.psu.edu>)

Accreditation

All College of Engineering baccalaureate majors at Penn State University Park, with the exception of Computer Science, are accredited by the Engineering Accreditation Commission of ABET, Inc (<http://www.abet.org>).

Departments and Schools

Department of Acoustics

The Graduate Program in Acoustics is an interdisciplinary program that applies broad academic offerings to a variety of scientific and technological fields. Personalize your education by selecting from an array of courses such as physical acoustics, underwater acoustics, signal processing, medical, aeroacoustics, vibrations, wave propagation, physiological acoustics, and more.

MORE INFORMATION (<http://www.acs.psu.edu/>)

Department of Aerospace Engineering

Aerospace engineering is the primary field of engineering concerned with the design, development, testing, and production of aircraft, spacecraft, and related systems and equipment. The field has traditionally focused on problems related to atmospheric and space flight, with two major and overlapping branches: aeronautical engineering and astronautical engineering.

MORE INFORMATION (<https://www.aero.psu.edu/>)

Department of Agricultural and Biological Engineering

Biological and agricultural engineering is the integration of engineering fundamentals with biological, agricultural, and environmental sciences. A holistic approach is taken in studying agricultural production, processing of food and other bio-based materials, and natural resource protection,

then applied to grand engineering challenges such as providing safe food and clean water.

MORE INFORMATION (<https://abe.psu.edu/>)

Department of Architectural Engineering

Architectural Engineering focuses on the scientific and engineering aspects of planning, designing, constructing, and analyzing buildings. Architectural engineers focus on building structure, stability, and systems, including: Planning, designing, and analyzing acoustics; building sustainability and safety aspects; construction management; heating, ventilating, and air conditioning systems; and lighting and electrical systems.

MORE INFORMATION (<http://www.ae.psu.edu/>)

Department of Biomedical Engineering

The Department of Biomedical Engineering is built upon the apex of engineering, medicine, healthcare policy and biological discovery. Biomedical engineering prepares students to become future leaders in the areas of medical device design, instrumentation, medical imaging, healthcare management, biomedical research and academia.

MORE INFORMATION (<http://www.bme.psu.edu/>)

Department of Chemical Engineering

Chemical engineering combines the principles of chemistry, biology, mathematics and physics to solve some of today's most pressing societal issues in human health, environmental sustainability, and energy.

MORE INFORMATION (<http://www.che.psu.edu/>)

Department of Civil and Environmental Engineering

Civil engineering educates future engineers through solid science and engineering principles by identifying engineering challenges, creating pioneering solutions, and leading the industry with research discoveries and design innovations. We tackle some of the major problems facing society today in order to advance the fields of civil and environmental engineering.

MORE INFORMATION (<http://www.cee.psu.edu/>)

School of Electrical Engineering and Computer Science

The School of Electrical Engineering and Computer Science (EECS) was created in 2015 to allow greater access to courses offered by both departments in exciting collaborative research in fields. EECS focuses on the convergence of technologies and disciplines to meet today's industrial demands.

MORE INFORMATION (<http://www.eecs.psu.edu/>)

Department of Engineering Science and Mechanics

The Penn State Department of Engineering Science and Mechanics (ESM) is an internationally distinguished department that is recognized for its globally competitive excellence in engineering and scientific accomplishments, research, and educational leadership.

Our engineering science program is the official undergraduate honors program of the College of Engineering, attracting the University's brightest engineering students. We also offer graduate degrees in ESM, engineering mechanics, engineering at the nano-scale, and an integrated undergraduate/graduate program.

MORE INFORMATION (<http://www.esm.psu.edu/>)

Department of Industrial and Manufacturing Engineering

Industrial engineers (IEs) design systems and processes to eliminate wastefulness and improve efficiencies. IEs are trained to be problem solvers that have an eye toward innovation and sustainability. They work in a variety of fields to develop solutions for challenges in management, manufacturing, logistics, health systems, retail, service, and ergonomics.

MORE INFORMATION (<http://www.ime.psu.edu/>)

Department of Mechanical and Nuclear Engineering

Mechanical engineering provides the foundation for almost all other engineering majors, designing everything from athletic equipment, medical devices, theme park rides, and personal computers to engines and powerplants. Nuclear engineers may apply skills to treat diseases, operate nuclear energy systems, develop regulations to ensure safety, or facilitate space exploration.

MORE INFORMATION (<http://www.mne.psu.edu/>)

School of Engineering Design and Innovation

The School of Engineering Design and Innovation (SEDI) delivers effective engineering education through active, collaborative, project-based, and professionally oriented classroom experiences. SEDI offers a variety of programs that partner faculty, students, and industry in the study of real-life engineering problems and solve them with innovative, humanitarian solutions.

MORE INFORMATION (<http://sedtapp.psu.edu/>)

Resources

Center for Engineering Outreach and Inclusion

The Center for Engineering Outreach and Inclusion assists women and multicultural students in the pursuit of their degrees, through support and student programs, scholarships, professional development, and academic assistance.

MORE INFORMATION (<http://inclusion.engr.psu.edu/>)

Career Resources & Employer Relations

The Career Resources & Employer Relations provides career advising for all students within the College of Engineering. We also help connect students and employers at a wide variety of career events each academic year, including Career Fairs, information sessions, student envoys, eCareer, and more.

MORE INFORMATION (<http://career.engr.psu.edu/>)

Global Engineering Engagement

Engineering students at Penn State have so many options available to them - from semester-long programs to global experiences embedded in classes. Student Study Abroad representatives offer students peer-to-peer information, advice, and insight on the study abroad experience.

MORE INFORMATION (<http://global.engr.psu.edu/>)

Contact

Peter Butler

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pjb28@psu.edu

George Lesieutre

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COLLEGE OF ENGINEERING
208 Hammond Building
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<http://advising.enr.psu.edu/>

Health and Human Development

About the College

Craig J. Newschaffer, Dean, College of Health and Human Development

Improving human lives through innovative research, teaching, and outreach activities is the defining goal of the College of Health and Human Development. Our educational programs emphasize interdisciplinary approaches and engaged experiential learning. We truly are "committed to improving the quality of your life." Our faculty represent some of the most respected scholars in their disciplines, outstanding researchers, teachers, and leaders in numerous national academies and organizations. Their accomplishments speak volumes about the stimulating intellectual environment that the college has created and sustained. The college attracts intelligent, motivated and passionate students. In addition to outstanding courses in the classroom, students engage in internships, study abroad experiences, research projects, and service-learning activities that bring them into direct contact with industry, patients, clients, families, and consumers. These experiences provide students with real-world opportunities to hone their professional skills and expand their education while improving the world in which we live.

MORE INFORMATION ABOUT THE COLLEGE (<https://hhd.psu.edu/>)

Mission and Goals

The College of Health and Human Development is a collaborative community of faculty, staff, students, and alumni that seeks to improve human health, development, and the quality of life for all people through innovative education, interdisciplinary research, and effective outreach with a scope that encompasses "cells to society" and conception through the end of life.

MORE INFORMATION (<https://hhd.psu.edu/about/strategic-plan/>)

Departments and Schools

Department of Biobehavioral Health

Innovative and interdisciplinary in nature, the Biobehavioral Health graduate program focuses on the unique space where biological, psychological, environmental, and cultural factors converge to affect health and disease across the lifespan.

MORE INFORMATION (<https://hhd.psu.edu/bbh/biobehavioral-health-graduate-program/>)

Department of Communication Sciences and Disorders

Communication Sciences and Disorders graduate students learn how to assess, diagnose, and treat speech, language, and hearing disorders while mastering core knowledge of the communication disorders that affect nearly 10 percent of the world's population.

MORE INFORMATION (<https://hhd.psu.edu/csd/communication-sciences-and-disorders-graduate-program/>)

Department of Health Policy and Administration

The graduate program in Health Policy and Administration provides a solid foundation for students who want to profoundly shape health policy, make vital future changes to global health-related organizations, and successfully navigate our increasingly complex health care environment—including managing the facilities, services, programs, staff, and budgets that providers rely on.

MORE INFORMATION (<https://hhd.psu.edu/hpa/health-policy-and-administration-graduate-program/>)

School of Hospitality Management

One of the first programs of its kind in the world, the graduate Hospitality Management program at Penn State is also widely considered one of the best. Our advanced degree programs rigorously prepare top-tier professionals for a wide array of careers in top-level service management, research, and academia through a combination of in-depth, research-based study and hands-on experience working alongside industry-leading practitioners and faculty.

MORE INFORMATION (<https://hhd.psu.edu/shm/hospitality-management-graduate-program/>)

Department of Human Development and Family Studies

The innovative doctoral program in Human Development and Family Studies takes a true lifespan approach to examining the complex intersection of human development and societal relationships, offering choices in core research areas, along with a rich variety of dynamic cross-cutting research themes.

MORE INFORMATION (<https://hhd.psu.edu/hdfs/human-development-and-family-studies-graduate-program/>)

Department of Kinesiology

One of the top-ranked programs of its kind, the Kinesiology graduate program has a long and distinguished record of producing leaders in the field. The national and international prominence of the program is due to the excellence of our graduate faculty, the production and dissemination of quality research, and the mentoring and graduation rates of excellent graduate students.

MORE INFORMATION (<https://hhd.psu.edu/kines/kinesiology-graduate-program/>)

Department of Nutritional Sciences

Through advanced training in research, leadership, education, and community engagement, Nutritional Sciences graduate students, take part in a breadth of experiences that include applied research in clinical and community settings, as well as a robust body of research focusing

on cellular and molecular mechanisms of specific nutrients in relation to metabolism and other physiological properties.

MORE INFORMATION (<https://hhd.psu.edu/nutrition/nutritional-sciences-graduate-program/>)

Department of Recreation, Park, and Tourism Management

Thanks to a cutting-edge curriculum—and unique research and hands-on learning opportunities offered through exclusive relationships with industry partners and professional organizations—graduate students will exit the program with a deep understanding of how the social, environmental, psychological, and economic aspects of a broad array of leisure activities and pursuits can truly transform people's lives and sense of well-being.

MORE INFORMATION (<https://hhd.psu.edu/rptm/recreation-park-and-tourism-management-graduate-program/>)

Resources

HHD Graduate Student Council

The College's Graduate Student Council is a group of student representatives from each of the academic units that meets on a monthly basis with the Associate Dean for Research and Graduate Education. The mission of this council is to serve as a vehicle to enhance graduate student representation to the College; to foster inter-departmental collaboration among students and faculty in research areas of mutual interest within the College; and to provide a mechanism for direct communication between department-selected graduate student representatives and College administration.

MORE INFORMATION (<https://hhd.psu.edu/hhd/graduate/hhd-graduate-student-council/>)

Office for Diversity and Inclusion

The mission of the Office for Diversity and Inclusion is to promote and enhance the diversity of the college's faculty and student body, and to foster a welcoming and inclusive environment for everyone. We support the college's efforts to recruit, retain, and graduate underrepresented students in our majors.

MORE INFORMATION (<http://hhd.psu.edu/college/diversity/>)

Research and Research Centers

Faculty in the College of Health and Human Development are world renowned for multidisciplinary research on all aspects of human health, developmental sciences, and management in hospitality, healthcare, human services, recreation and other service organizations. Graduate students have opportunities to work with some of the brightest and most well-respected researchers in the world.

MORE INFORMATION (<https://hhd.psu.edu/hhd/research/research-centers/>)

Career Resources

Graduates from the College of Health and Human Development work in nearly every segment of the services economy—healthcare, hospitality, recreation, academia, research, management and/or policymaking. The rapidly growing career paths offer meaningful and purposeful work improving the quality of life for people.

MORE INFORMATION (<https://hhd.psu.edu/hhd/graduate/career-opportunities/>)

Contact

Kathryn Drager, PhD, CCC-SLP

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Information Sciences and Technology

About the College

Andrea Tapia, Dean, Information Sciences and Technology

In the College of Information Sciences and Technology (IST) graduate programs, we are committed to research and applications that focus on real-world technology-related problems that impact people's everyday lives. Our students are challenged to think critically and to recruit interdisciplinary perspectives and skills to tackle the greatest research challenges of the 21st century. Our internationally distinguished faculty bring formal training and research expertise from business, computer science, education, information science, psychology, engineering, sociology, mathematics, law, and other fields. Our masters and doctoral graduates bring their research and problem-solving skills to both cutting-edge information technology companies and traditional academic careers. In the graduate programs of IST, we identify and pursue problems that are a novel combination of human, information and computer science, investigating difficult and inter-connected problems. Our goal is to generate scientifically-grounded solutions that will improve the way people live, work, and play.

MORE INFORMATION ABOUT THE COLLEGE (<https://ist.psu.edu/college/about/>)

Mission and Goals

Our mission is to educate students who can meet the challenges of the 21st century information age; to conduct leading-edge research by integrating people and information and technology; and to carry out service activities that address global problems and challenges.

MORE INFORMATION (<https://ist.psu.edu/about/we-are/mission/>)

Resources

Career Solutions

The Office of Career Solutions and Corporate Engagement assists students with pursuing their career-related goals. They offer a variety of programs, services, and resources to help students pursue professional opportunities such as resume reviews, career fairs, networking events, and job and internship postings.

MORE INFORMATION (<https://ist.psu.edu/students/careers/>)

Inclusion and Diversity Engagement

The Office of Inclusion and Diversity Engagement works to support a welcoming and inclusive community in the College of IST. They aim to create and maintain an equitable climate by developing strategies that

engage and retain students, faculty, and staff from underrepresented groups, including women.

MORE INFORMATION (<https://ist.psu.edu/college/about/diversity/oide/>)

Contact

Jeffrey Bardzell

Associate Dean for Undergraduate and Graduate Studies
College of Information Sciences and Technology
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814-865-3528

<https://ist.psu.edu/about/contact> (<https://ist.psu.edu/about/contact/>)

Intercollege

About the College

When faculty members from departments in two or more colleges collaborate in offering a graduate major degree program, the program may be designated as an intercollege graduate degree program. A committee of graduate faculty members approved by the Graduate School is responsible for administering an intercollege program under a program chair. Some intercollege graduate degree programs are academically housed in the Graduate School; some are housed in other colleges or academic units. Since intercollege graduate degree programs draw on faculty and courses from several colleges, specific college contact information can be found on each individual program page.

International Affairs

About the School

Victor Romero, Interim Dean, School of International Affairs
Mitchell Smith, Director, School of International Affairs

The School of International Affairs (SIA) is uniquely situated to provide an innovative education for the next generation of global leaders. Our Master of International Affairs (M.I.A.) degree is a small, hands-on, customizable, interdisciplinary program with access to all of the resources of a leading public research institution. The SIA faculty is comprised of internationally recognized scholars and seasoned former officials from a variety of disciplines, which allows us to offer a curriculum that can be tailored to meet students' individual career goals. Through our program, students can take advantage of myriad opportunities including internships in Washington, D.C., New York, and across the globe; and optional concentrations in focus areas based on the student's personal interests. To further prepare students for a professional career, SIA offers a dedicated Office of Career Services that helps students identify goals and develop a plan for attaining them. Our Career Services team also coordinates career exposure trips, professional development workshops, and visits by recruiters. When our students graduate, they are ready to help shape the future of our complex world.

MORE INFORMATION ABOUT THE SCHOOL (<https://www.sia.psu.edu>)

Mission and Goals

Offering a professional master's degree in international affairs with several specialty areas of study, our mission is to prepare exceptional students for careers and leadership positions in both the private and

public sectors of an increasingly interdependent world. The School of International Affairs fulfills this mission through:

- A flexible degree program taught by elite, interdisciplinary faculty
- Experiential learning, including internship and international opportunities
- A dedicated Office of Career Services that works with each individual student

MORE INFORMATION (<https://www.sia.psu.edu/explore-sia/welcome/>)

Resources

Academic Advising

Throughout the program, M.I.A. students will periodically meet with the director of academic advising to review their plan of study, intended concentration, elective course selections, and address any academic or student-related issues. In addition, incoming students are assigned a full-time faculty member who will help to guide their academic interests based on their professional aspirations.

Faculty

The School of International Affairs has brought international experts from a variety of fields into the Penn State community. The current faculty include former ambassadors, senior government advisors, higher education leaders, senior officials of international organizations, and foreign policy experts, each of whom bring unique regional and subject matter expertise in addition to their other exceptional accomplishments. Together, they represent a unique combination of world-class scholars and highly acclaimed practitioners in their respective disciplines.

Office of Career Services

Professional career opportunities have the highest priority at the School of International Affairs. Students will work, from their first semester, with the director of career services. Career Services will connect students to the strongest possible network of opportunities prior to and upon graduation, through the resources offered by Penn State, its faculty and alumni worldwide, as well as a range of multinational organizations, institutions, and enterprises.

Contact

Elizabeth Ransom

Interim Director, School of International Affairs
253 Lewis Katz Building
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SCHOOL OF INTERNATIONAL AFFAIRS

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admissions@sia.psu.edu

<http://sia.psu.edu>

Liberal Arts

About the College

Clarence E. Lang, Dean, College of the Liberal Arts

Students in the College of the Liberal Arts have access to a world-class education in the core values of the Liberal Arts, to enriching out-of-class

experiences, and to a Penn State family invested in your success. We call this unique combination of opportunities the Liberal Arts Edge. Training in the Liberal Arts tradition helps students to think critically and creatively, to communicate artfully, and to motivate and inspire others. Working with their departments, graduate students have many opportunities to conduct research appropriate for their disciplines, and obtain appropriate experiences teaching and apprenticing with faculty.

MORE INFORMATION ABOUT THE COLLEGE (<http://laus.la.psu.edu/>)

Mission and Goals

Building upon its status as one of the premier public liberal arts institutions, the College of the Liberal Arts seeks to offer a transformative 21st-century education that prepares students to thrive in today's society. The College will fulfill this mission by:

- Providing an education that combines core liberal arts values with research, teaching, and global experiences that allow students to apply skills in real-world contexts and grow personally and professionally
- Recruiting and retaining the best liberal arts faculty to help students develop wisdom and skills to influence and respond to change
- Supporting graduate students with placement in academic and non-academic careers as they complete their educational experience.

MORE INFORMATION (<http://www.la.psu.edu/about/message-from-the-dean/>)

Departments and Schools

Department of African American Studies

The Department of African American Studies is a meeting ground for scholars, students and thinkers committed to the study of African American and African-descended peoples in the Americas. As we foster meaningful engagement with the economic, social and political conditions of black life on campus and beyond, we seek to build a vibrant community of inquiry and innovation at Penn State.

MORE INFORMATION (<http://afam.la.psu.edu/>)

African Studies Program

The African Studies Program offers many opportunities for students to learn about important historical, social, political, and economic features of the African continent. The African Studies Program seeks to expand student knowledge of Africa by, among other things, highlighting Africa's place in the global community, the vital geo-resources sustaining the world's ecosystems, the depth of its artistic creativity and the resourcefulness of its peoples.

MORE INFORMATION (<http://afr.la.psu.edu/>)

Department of Anthropology

Anthropology is the study of humanity—our biology and behavior, past and present. Anthropologists study living people across cultures and populations; past people through fossil, archeological, and historical records; as well as living and extinct nonhuman primates. Our students gain holistic, integrative social science training in and out of the classroom.

MORE INFORMATION (<http://anth.la.psu.edu/>)

Department of Applied Linguistics

Our mission is to advance understandings of language use and language learning from a range of anthropological, sociological, and psychological perspectives. Our faculty are committed to teaching and mentoring students. They are recognized worldwide for their topically and geographically diverse research involving a broad spectrum of languages and settings.

MORE INFORMATION (<http://aplng.la.psu.edu/>)

Department of Asian Studies

The Asian Studies program offers students opportunities to study in Asian Studies, Chinese and Japanese. At the graduate level, we offer dual-title doctoral programs in partnership with History, Comparative Literature, Applied Linguistics, and Political Science. Students who take courses in our department learn to think critically, to make literary, political, and historical judgments, to understand the impact of the past on the present, and of present choices on the future. Our language programs offer deep immersion in new cultural contexts and broaden linguistic and social horizons.

MORE INFORMATION (<http://asian.la.psu.edu/>)

Department of Classics and Ancient Mediterranean Studies

CAMS is the study of ancient civilizations that arose and flourished around the Mediterranean basin (including Egypt, Greece, Rome, Anatolia, Israel, Mesopotamia, and North Africa) from the "cradle of civilization" in Mesopotamia (ca. 4000 BCE) to the end of Greco-Roman antiquity (ca. 600 CE). CAMS investigates the whole scope of the ancient Mediterranean world and trains students to interpret the linguistic and archaeological evidence of the greatest ancient cultures.

MORE INFORMATION (<http://cams.la.psu.edu/>)

Department of Communication Arts and Sciences

CAS is committed to the study, teaching, and practice of human communication for the betterment of Pennsylvania, the nation, and the world. Using methods and theories that span the humanities and social sciences, we create knowledge about the role of communication in diverse interpersonal, communal, national, international, and cultural settings.

MORE INFORMATION (<http://cas.la.psu.edu/>)

Department of Comparative Literature

Our department offers exciting ways to study literature and culture in a global context, to examine global media (print, visual, electronic), and to explore questions of ethics, human rights, and the real-world contexts of literary and cultural production. Training students in important skills such as analytical writing, argumentation, and communication in an international context, Comparative Literature provides many of the key components to success in the global economy.

MORE INFORMATION (<http://complit.la.psu.edu/>)

Department of Economics

Economics studies the allocation of scarce resources. At the core of economics are theories of how individuals, firms, and other organizations make choices and interact, taking into account constraints on their behaviors. Among the topics studied in economics are: the determination of prices and quantities in various types of markets; the effects of taxes,

subsidies, and regulations; economic growth and income distribution; international trade and international finance; and more.

MORE INFORMATION (<http://econ.la.psu.edu/>)

Department of English

Our students explore the imaginative and practical uses of English through courses in literature, writing, rhetoric, and language. They develop perspectives on human nature and cultural values through American, British, and other English literatures; they learn how to gather, analyze, synthesize, and communicate information; they gain mastery over their language. These skills help English majors find careers in such fields as publishing, business, industry, government, and teaching.

MORE INFORMATION (<http://english.la.psu.edu/>)

Department of French and Francophone Studies

The French language is the most direct route to 150,000,000 people in over 40 countries and territories of Europe, Africa, Asia, North America, and Latin America. If your goals include a future that requires contact with these diverse peoples or if your plan is to teach French, we offer a variety of options that will fit your needs: French/business, French/engineering, French language and culture, French language and literature, French language and linguistics, and applied French.

MORE INFORMATION (<http://www.french.psu.edu/>)

Department of Germanic and Slavic Languages and Literatures

We offer undergraduate and graduate degrees in German and Russian. Other Slavic languages offered include Ukrainian, Polish, and Czech. Our award-winning faculty is committed to teaching and research in the areas of language, literature and culture.

MORE INFORMATION (<http://german.la.psu.edu/>)

School of Global Languages, Literatures, and Cultures

The School's purpose is to promote the study and knowledge of languages, literatures, and cultures worldwide. Its member departments offer graduate and undergraduate degrees, study abroad programs, student research opportunities, internships, and more.

MORE INFORMATION (<http://sll.la.psu.edu/>)

Department of History

The Penn State Department of History offers a small, focused, PhD program designed to prepare students for careers inside or outside academia. Our program admits students in four primary fields, which reflect faculty strength: 1) the United States; 2) Latin America; 3) Early modern global; and 4) China & South Asia.

MORE INFORMATION (<http://history.la.psu.edu/>)

Jewish Studies Program

Our interdisciplinary program ranges globally in scope from the Israelite origins of the Jewish people to the experiences of postmodern Jews in the 21st century. Our distinguished faculty offer courses across a diverse array of fields and topics, with perspectives that combine the humanities and the social sciences. We offer a major and minor in Jewish Studies, a minor in Hebrew, and a certificate in Holocaust and Genocide Studies.

MORE INFORMATION (<http://jewishstudies.la.psu.edu/>)

School of Labor and Employment Relations

The School of Labor and Employment Relations offers Masters Programs that focus on human resources, employment relations, and labor. Students in our programs benefit from being part of the school's tight-knit academic and practitioner community, while enjoying the benefits of being associated with a large, world-class university known around the globe.

MORE INFORMATION (<http://lser.la.psu.edu/>)

Department of Philosophy

The graduate program in Philosophy has particular strengths in Continental Philosophy, Critical Philosophy of race, and Feminist Philosophy. Graduate training in Philosophy at Penn State focuses on these areas while providing all graduate students with a strong foundation in the history of philosophy and encouraging genuine dialogue across multiple philosophical traditions, including continental, analytic, and American Philosophy. Graduate students have the option of pursuing dual-title doctoral degrees in Women's, Gender, and Sexuality Studies or African American and Diaspora Studies. Doctoral minors in social thought and literary theory, criticism, and aesthetics are available as well.

MORE INFORMATION (<http://philosophy.la.psu.edu/>)

Department of Political Science

The Department of Political Science at Penn State provides doctoral students with opportunities to develop their expertise as researchers and as teachers in four areas: American politics, comparative politics, international relations, and political methodology. We also offer dual-title doctoral degrees with Asian Studies, Women's Studies, African Studies, and Social Data Analytics.

MORE INFORMATION (<http://polisci.la.psu.edu/>)

Department of Psychology

Penn State's Department of Psychology trains the next generation of leaders, innovators, and cutting-edge professionals in five areas: clinical (adult and child), cognitive, developmental, industrial-organizational, and social psychology. Students in our program become first-rate scientists and thinkers; learn through active participation (conducting their own research, using state of the art research methodologies, teaching the next generation of students, and effectively using their expertise to assist and improve the community) and translating research into action to help improve people's lives.

MORE INFORMATION (<http://psych.la.psu.edu/>)

Department of Sociology and Criminology

Ranked among the top programs in the nation, Penn State's Department of Sociology and Criminology offers 3 MA programs (MA in Sociology; MA in Criminology; MA in Sociology and Demography) and among PhD programs (PhD in Sociology; PhD in Criminology; PhD in Sociology and Demography; PhD in Sociology and Social Data Analytics).

MORE INFORMATION (<https://sociology.la.psu.edu/>)

Department of Spanish, Italian and Portuguese

Our department is at the forefront of literary, linguistic and cultural studies in the United States. Our mission is to provide training that not only meets the highest standards of professional research but also prepares students for civic engagement and intellectual autonomy.

MORE INFORMATION (<http://sip.la.psu.edu/>)

Department of Women's, Gender, and Sexuality Studies

Women's Studies is an interdisciplinary field of research and teaching that places women's lives, perspectives, and experiences at the center of inquiry. Women's Studies asks questions regarding the diversity of women's lives and experiences throughout history, contemporary problems from the perspectives of women and gender, and how changes in fundamental assumptions about the production of knowledge have transformed conventional areas of study. We offer dual-title masters and doctoral degree programs with Art Education, Comparative Literature, Curriculum & Instruction, English, French, Geography, History, Philosophy, Political Science, Psychology, and Rural Sociology.

MORE INFORMATION (<http://www.womenstudies.la.psu.edu/>)

Contact

D. Scott Bennett

Associate Dean for Research and Graduate Studies
College of The Liberal Arts
105 Sparks Building
University Park, PA 16802
814-865-1439

<http://la.psu.edu>

Medicine

About the College

Karen Kim, Dean, College of Medicine

Graduate Programs at the Penn State College of Medicine permit students to choose their dissertation adviser and committee members from the approximately 150 faculty members of the Program who represent more than 20 basic science and clinical departments. Research interests of Program faculty members are wide-ranging in both scientific disciplines and specific research interests. Graduate students benefit from the opportunity to tailor both their coursework and research to align closely with their particular interests. The objective of Graduate Programs at The Penn State College of medicine is to train individuals for advanced professional careers in the Biomedical Sciences, Neuroscience, Anatomy, Public Health Sciences and related fields.

MORE INFORMATION ABOUT THE COLLEGE (<https://med.psu.edu/about/>)

Mission and Goals

At Penn State College of Medicine we are committed to educating graduate students in basic medical sciences and others in public health-related professions. We seek to enroll students of exceptional quality, and provide them with a rigorous education and research environment allowing them to develop the skills necessary to be future leaders in their field.

MORE INFORMATION (<https://med.psu.edu/mission-values/>)

Departments and Schools

The College of Medicine has seven basic science departments that include Biochemistry and Molecular Biology, Cellular and Molecular Physiology, Comparative Medicine, Microbiology and Immunology, Neural and Behavioral Sciences, Pharmacology, and Public Health Sciences.

Additionally, a number of other departments house basic scientists and physician-scientists that train graduate students. These include: Anesthesiology, Dermatology, Medicine, Neurology, Neurosurgery, Obstetrics and Gynecology, Ophthalmology, Orthopaedics, Pathology, Pediatrics, Physical Medicine and Rehabilitation, Psychiatry and Surgery.

Graduate Programs

At the College of Medicine, there are no department-based graduate programs, with the exception of Public Health Sciences. The following represent the integrative doctoral programs at the College of Medicine:

The doctoral degree in **Anatomy** provides coursework to help students achieve advanced understanding of specific knowledge related to human anatomic sciences, including medical gross anatomy, human embryology and human microscopic anatomy.

MORE INFORMATION (<http://med.psu.edu/anatomy-phd/>)

The doctoral degree program in **Biomedical Sciences (BMS)**, with its options in Biochemistry and Molecular Genetics, Translational Therapeutics, Cellular and Integrative Physiology, and Virology and Immunology, is a nationally and internationally recognized interdisciplinary graduate program that provides students curricular and research training with a unique focus on human health and disease. Students receive rigorous training that provides the skills necessary to be leaders in biomedical research and other endeavors including business, education, law, journalism, and public policy.

MORE INFORMATION (<http://med.psu.edu/biomedical-sciences-phd/>)

The doctoral degree program in **Biostatistics** focuses on preparing students to develop new means of uncovering key scientific discoveries using cutting edge analytical and bioinformatics. Technological advances in areas such as imaging, high throughput omics, and electronic medical records constantly add demand for graduate training in Biostatistics.

MORE INFORMATION (<http://med.psu.edu/biostatistics-phd/>)

The doctoral degree program in **Neuroscience** brings together scientists from different basic and clinical disciplines to focus on the nervous system. Some researchers seek to clarify the development or function of the brain at the cellular, molecular, or genetic levels. Others seek to understand how the nervous system processes information, controls autonomic functions, regulates states of consciousness, or determines behavior. Still others search for the means to diagnose, prevent, and successfully treat malignant brain tumors, congenital and acquired brain diseases, neurodegenerative diseases, or dysfunctions caused by pathologic states in brain structure.

MORE INFORMATION (<http://med.psu.edu/neuroscience-phd/>)

Public Health Sciences offers the following degrees: Master of Public Health (MPH), Doctor of Public Health (DrPH), Master's degree in Public Health Sciences and Homeland Security – Public Health Preparedness. As a national leader in research, education and outreach, the Department of Public Health Sciences aims to advance theory and practice that prepares future public health professionals, improves population health, and reduces health disparities across communities in Pennsylvania, the nation, and internationally.

MORE INFORMATION (<http://med.psu.edu/phs/>)

Resources

Career Services

Penn State College of Medicine Career Services assists graduate students in preparing for and pursuing meaningful and rewarding careers through a comprehensive array of programs and services. The College has a full-time career counselor dedicated to assisting graduate students.

Graduate Student Association

The Graduate Student Association (GSA) is a group of students made up of elected and appointed students who help run student life at Penn State College of Medicine. The GSA helps to facilitate communication between the student body and program administration, as well as coordinate events such as the annual Research Forum to provide educational opportunities for all members of the Penn State College of Medicine community. Members of the GSA also try to help new students adjust to graduate school life through social and academic services.

Office of Diversity and Inclusion

Penn State Health and Penn State College of Medicine address diversity and inclusion from a measurable, strategic perspective that includes, as a foundation, equal employment regulatory compliance. Our commitment is communicated in the University's diversity statement, which provides the foundation for our initiatives, as well as in our campus' mission and vision statements on diversity, equity and inclusion. Penn State Health and Penn State College of Medicine are change agents and leaders in Hershey and the surrounding communities, promoting diversity and inclusion as a way to make the educational, work and local communities better and our businesses more successful.

Student Mental Health and Counseling

The Office of Student Mental Health and Counseling (OSMHC) is designed to meet the needs of Penn State College of Medicine students with compassion, honesty, and confidentiality. All issues are taken seriously – no problem is “too small” to talk about. This includes crisis and support services.

Student Housing

University Manor is a housing complex situated on the campus of the Penn State College of Medicine and which graduate students can live.

Student Health

Healthcare is available to students and their immediate families through Student Health Services. Student Health is a division of the Department of Family and Community Medicine at Milton S. Hershey Medical Center, Penn State College of Medicine.

Core Facilities and Research Resources

Penn State College of Medicine has shared-service core research facilities that provide specialized instrumentation and analytical services for the conduct of basic, clinical, and translational research. These include, but are not limited to, flow cytometry, genomic analysis, imaging, informatics and data analysis, mass spectrometry and proteomics, pathology and specimen processing, drug discovery, supply center, transgenics and animal services.

MORE INFORMATION (<http://med.psu.edu/core-facilities/>)

Contact

Charles H. Lang, Ph.D.

Associate Dean for Graduate Studies

Distinguished Professor of Cellular and Molecular Physiology and Surgery
Department of Cellular and Molecular Physiology
717-531-8892
chl1@psu.edu

Penn State Erie, The Behrend College About the College

Ralph M. Ford, Chancellor, Penn State Erie, The Behrend College

Penn State Erie, The Behrend College, gives undergraduate and graduate students the best of two worlds: The friendly, student-centered environment of a smaller college with the academic resources of a major research university. We offer an academically rigorous, globally respected Penn State education in a setting where students can have close interaction with faculty and meaningful out-of-classroom experiences. With more than 4,500 undergraduate and graduate students, 80-plus academic programs, and an inspiring 854-acre campus, Penn State Behrend is among the largest campuses in the Penn State system. We're one of the top public colleges and universities in Pennsylvania for student-to-faculty ratio, SAT scores, first-year student retention rate, and graduation rate, based on U.S. News & World Report data. Penn State Behrend's faculty-to-student ratio is 1:16, and the average class size is 26.

MORE INFORMATION ABOUT THE COLLEGE (<http://behrend.psu.edu/>)

Mission and Goals

There are six hallmarks of the Penn State Behrend experience:

- High Quality: Excellence in academics, research, and outreach
- Student-Centeredness
- Advanced Technology: State-of-the-art classrooms and labs.
- Inspiring Campus Environment
- Diversity: Behrend is a laboratory for ideas, and the more perspectives that can be brought to bear, the greater the learning
- Land-Grant Commitment: We are an economic, social, and cultural catalyst in northwestern Pennsylvania and beyond

MORE INFORMATION (<https://behrend.psu.edu/about-the-college/college-strategy/>)

Departments and Schools

Black School of Business

The Black School of Business is accredited by AACSB International, the premier accrediting agency for management education. A technology-rich environment and unique learning opportunities are made possible by a \$20 million endowment from the late insurance executive Samuel P. Black Jr. and his wife, Irene. Graduate programs offered by the Black School include Master of Business Administration, Master of Professional Accounting, Master of Project Management, and Master of Manufacturing Management, which is offered jointly with the School of Engineering.

MORE INFORMATION (<http://behrend.psu.edu/school-of-business/>)

School of Engineering

The School of Engineering is ranked among the top 29 undergraduate engineering programs nationwide. Why? State-of-the-art facilities, award-winning faculty, ABET-accredited programs in both engineering and

engineering technology, small class sizes, emphasis on meaningful student design and research experiences, and superior internship and job placement. The school offers an interdisciplinary Master of Manufacturing Management, with program delivery primarily online.

MORE INFORMATION (<http://behrend.psu.edu/school-of-engineering/>)

School of Humanities and Social Sciences

The School offers diverse four-year degree programs that develop both intellect and practical skills. Our students are tomorrow's historians, writers, communicators, and educators, exploring and reflecting on our society and the larger world beyond. Highly accomplished faculty are scholars, writers, and skilled teachers with years of practical professional experiences. The School offers a Master of Arts in Applied Clinical Psychology.

MORE INFORMATION (<http://behrend.psu.edu/school-of-humanities-social-sciences/>)

School of Science

School of Science students receive a transdisciplinary, hands-on education in basic and applied sciences guided by experienced faculty using state-of-the-art instruments. Students have opportunities for community engagement, service learning, and internships. The hallmark of Science programs is the opportunity to conduct substantive research not typically offered at the undergraduate level.

MORE INFORMATION (<http://behrend.psu.edu/school-of-science/>)

Resources

Graduate Programs Office

Not sure how to get started in graduate education? The Graduate Programs Office can answer questions regarding program offerings, admissions requirements, and direct you to the faculty coordinator for the graduate program that interests you.

MORE INFORMATION (<https://behrend.psu.edu/admissions-financial-aid/graduate-admissions/>)

Educational Equity and Diversity Programs

Penn State Behrend is committed to promoting diversity. The Office of Educational Equity and Diversity Programs supports and serves as an advocate for diverse populations within the college community, creating an environment that promotes respect for differences while fostering caring relationships and cross-cultural understanding and appreciation.

MORE INFORMATION (<http://behrend.psu.edu/student-life/educational-equity-and-diversity/>)

English Language Study Center

The English Language Study Center offers classes and support services designed to help multicultural learners develop the reading, writing, and speaking skills needed to succeed on the job or in the university-level classroom.

MORE INFORMATION (<http://behrend.psu.edu/school-of-humanities-social-sciences/programs-events-1/the-english-language-study-center/>)

Health and Wellness Center

Penn State Behrend has two on-campus Health and Wellness Centers that can diagnose and treat most illnesses and minor injuries. The

centers also help students to manage chronic health conditions or obtain needed immunizations. Most major insurances are accepted.

MORE INFORMATION (<http://behrend.psu.edu/student-life/student-services/health/>)

Open-Lab Learning

Penn State Behrend's open-lab philosophy creates relevant learning experiences by bringing business and industry together with students and faculty members. Together, these academic-professional teams work to solve business, industry, and community challenges and pursue research and development initiatives.

MORE INFORMATION (<http://behrend.psu.edu/academics/academic-programs/open-lab-learning/>)

Personal Counseling

The Office of Personal Counseling offers free individual counseling, support groups, and psychiatric and crisis intervention services to Penn State Behrend students. All services are free and confidential.

MORE INFORMATION (<http://behrend.psu.edu/student-life/student-services/personal-counseling/>)

Contact

Ivor Knight

Associate Dean for Research and Graduate Studies
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itk2@psu.edu

Penn State Great Valley

About the Campus

Colin J. Neill, Ph.D., Chancellor, Dean, and Chief Academic Officer, Penn State Great Valley

For over 60 years, Penn State Great Valley has been dedicated to providing high-quality educational programs to professionals in southeastern Pennsylvania. Located in Malvern, the campus offers graduate degrees and certificates in accounting, artificial intelligence, business, data analytics, engineering, finance, and leadership in addition to a variety of noncredit professional development programs. Evening and hybrid courses are held in a flexible, seven week format, allowing students to meet the demands of work, family, and life in general.

MORE INFORMATION (<https://greatvalley.psu.edu/this-is-penn-state/>)

Mission and Goals

To directly respond to the learning needs of working adult professionals and their organizations, Penn State Great Valley strives to develop and offer convenient, competitively priced, and technically advanced programming that improves the career potential and enhances the work effectiveness of our students and graduates.

Through the research of our faculty, our graduate programming, our continuing education programs, and conferences organized by Penn State Great Valley, we seek to promote the intellectual and economic vitality of our region. In all of our teaching, research, and service endeavors, the rigor, quality, and relevance of our programs bridge the gap between theory and practice.

MORE INFORMATION (<https://greatvalley.psu.edu/this-is-penn-state/mission-and-strategic-plan/>)

Departments and Schools

- Engineering Division
- Management Division

MORE INFORMATION (<https://greatvalley.psu.edu/academics/>)

Contact

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jan16@psu.edu

Penn State Harrisburg, The Capital College

About the College

David M. Callejo Pérez, Chancellor, Penn State Harrisburg

Penn State Harrisburg is an undergraduate college and graduate school of the University. The Harrisburg campus enrolls over 600 graduate students and offers more than 40 graduate programs, including master's and doctoral degrees and graduate and postbaccalaureate certificates. The college has nationally accredited programs, award-winning faculty who are accomplished teachers and scholars, and the resources of a world-class research university. Penn State Harrisburg is located on a suburban campus in Middletown, Pennsylvania, eight miles east of Harrisburg.

MORE INFORMATION (<https://harrisburg.psu.edu/this-is-penn-state-harrisburg/>)

Mission and Goals

The mission of Penn State Harrisburg is to provide an integrated and responsive approach to education that benefits society. As the largest and most comprehensive of the University's Commonwealth Campuses, we strive to achieve national and international standing in academic quality and impact upon the progress of society.

MORE INFORMATION (<https://harrisburg.psu.edu/about-us/vision-mission-and-values/>)

Departments and Schools

School of Behavioral Sciences and Education

The School of Behavioral Sciences and Education's programs promote the health and well-being of individuals, families, communities and society through education, physical and mental health research, treatment, and prevention. BSED offers graduate programs in psychology, literacy, and adult education, as well as numerous certifications and endorsements for educators.

MORE INFORMATION (<https://harrisburg.psu.edu/behavioral-sciences-and-education/>)

School of Business Administration

The School of Business Administration is the leading business education center in the region. Its MBA, MSIS, and Master of Professional Accounting programs are accredited by the Association to Advance

Collegiate Schools of Business (AACSB) International, the premier accrediting body for business schools, and a distinction earned by only 4.5% of business programs worldwide.

MORE INFORMATION (<https://harrisburg.psu.edu/business-administration/>)

School of Humanities

The School of Humanities offers graduate degrees in American studies (M.A. and Ph.D.), communications (M.A.), and humanities (M.A.), as well as graduate certificates in Folklore and Ethnography and Heritage and Museum Practice.

MORE INFORMATION (<https://harrisburg.psu.edu/humanities/>)

School of Public Affairs

The School of Public Affairs offers high quality graduate education in multiple disciplines in the form of four graduate degrees, five graduate certificates, and a doctoral degree. Its programs are grounded in applied research and an interdisciplinary approach, foster public service, and provide students with the knowledge and skills to solve society's complex problems.

MORE INFORMATION (<https://harrisburg.psu.edu/public-affairs/>)

School of Science, Engineering, and Technology

The School of Science, Engineering, and Technology offers master's degree study in Civil, Electrical, Environmental, and Mechanical Engineering; Computer Science; Engineering Science; Engineering Management; and Environmental Pollution Control.

MORE INFORMATION (<https://harrisburg.psu.edu/science-engineering-technology/>)

Resources

Career Services

Career Services provides career planning and development services to current students and alumni at no charge.

MORE INFORMATION (<https://harrisburg.psu.edu/career-services/>)

Counseling and Psychological Services

Psychologists, counselors, and a drug and alcohol specialist are available to work with any current student to address personal concerns. This office offers evening hours and operates under strict confidentiality guidelines.

MORE INFORMATION (<https://harrisburg.psu.edu/counseling-psychological-services/>)

Graduate and Professional Student Council (GPSC)

The GPSC is the voice for graduate and professional students, providing representation to the Student Government Association, the Graduate School, and all other entities that have an impact on graduate and professional students.

MORE INFORMATION (<http://sites.psu.edu/gpsc/>)

Graduate Studies Office

The Graduate Studies Office offers support for graduate students and represents the Graduate School at Penn State Harrisburg. Additionally, the office sponsors travel grants for grad students, implements academic

policies for graduate programs, and works with the Graduate and Professional Student Council (GPSC).

MORE INFORMATION (<https://harrisburg.psu.edu/graduate-studies/>)

Housing and Food Services

Housing and Food Services provides student resident services, catering, and operates several dining options on campus.

MORE INFORMATION (<http://harrisburgcampusliving.psu.edu/>)

International Programs (Study Abroad)

International Programs provides and facilitates international educational opportunities for faculty and students, including study tours and study abroad.

MORE INFORMATION (<https://harrisburg.psu.edu/international-programs/>)

International Student Support Services

Acts as a liaison between Penn State Harrisburg international students and the Office of Global Programs/DISSA at University Park, assisting with immigration issues, hosting employment information sessions, and providing personal development and growth opportunities for students.

MORE INFORMATION (<https://harrisburg.psu.edu/international-student-support-services/>)

Learning Center

The Learning Center provides tutoring to undergraduate and graduate students in quantitative courses (mathematics, science, business), writing, speeches and presentations, study skills, American and academic literacy. Our mission is to support students' self-management of academic and professional goals through collaboration, guidance, and practice in an environment of inclusive excellence.

MORE INFORMATION (<https://harrisburg.psu.edu/learning-center/>)

Library

This technologically advanced, academic research library includes 300,000 volumes and more than 200 print journals. The library also includes computer labs, multimedia production studios, classrooms, and a variety of study spaces.

MORE INFORMATION (<https://libraries.psu.edu/harrisburg/>)

Recreation and Aquatics

The campus has a modern fitness facility that includes: a 5,000-square-foot cardio/weight room, a full-size gymnasium, racquetball courts, group exercise rooms, and a variety of equipment that can be signed out. The Aquatics Center offers class and recreational swimming options including lap and open swim hours.

MORE INFORMATION (<https://harrisburg.psu.edu/recreation-and-aquatics/>)

Research and Outreach

ORO serves as the primary point of contact for external grant submissions, providing assistance with budget preparation, ensuring grants meet sponsor requirements and submitting grants to sponsors on behalf of the University. Additionally, it develops and maintains

relationships with individuals and entities from the public, organizations and private sectors.

MORE INFORMATION (<https://harrisburg.psu.edu/research-and-outreach/>)

Residence Life

Residence Life provides resources and activities to enhance the personal, physical, educational, and social development of campus residents.

MORE INFORMATION (<https://harrisburg.psu.edu/disability-services/>)

Student Disability Resources

The Student Disability Resources office provides students with disability accommodations to minimize the effects of their disabilities.

MORE INFORMATION (<https://harrisburg.psu.edu/disability-services/>)

Student Health Services

Assesses and treats student illnesses and provides wellness counseling and preventive health services. Clinician services are offered by appointment.

MORE INFORMATION (<https://harrisburg.psu.edu/student-health-services/>)

Student Life

More than 100 student clubs and organizations fit any interest, whether you're looking to get involved in service projects, join a fraternity or sorority, participate in decision-making for the college through Student Government, or join a club that will help you with your major or career goals.

MORE INFORMATION (<https://harrisburg.psu.edu/student-life/>)

University Police and Public Safety

The Department of University Police and Public Safety is staffed with sworn police officers and civilian personnel charged with the responsibility of providing a safe environment to the campus community. The police officers of the department enforce state laws as well as University rules and regulations.

MORE INFORMATION (<https://harrisburg.psu.edu/safety-police-services/>)

Contact

Omid Ansary, Ph.D.

Senior Associate Dean for Academic Affairs

Peter B. Idowu, Ph.D. (<https://harrisburg.psu.edu/faculty-and-staff/peter-idowu-phd/>)

Assistant Dean for Graduate Studies

PENN STATE HARRISBURG
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<https://harrisburg.psu.edu>

Ross and Carol Nese College of Nursing

About the College

Laurie Badzek, Dean, College of Nursing

Penn State's Nursing program began in 1964 to provide an academically-grounded, clinical training program for future nurses. Since then, the College of Nursing (CON) has steadily evolved to meet the demands of modern healthcare and provide diverse, hands-on clinical experiences, a well-rounded classroom curriculum and cutting-edge technology to today's students. The CON features a complete range of educational programs in nursing.

The baccalaureate degree program has three options for study: the B.S.N. (<https://www.nursing.psu.edu/general-bsn-degree-program/>), for those students who are entering the four-year program of study for an initial professional degree, the Second Degree option (<http://www.nursing.psu.edu/undergrad/second-degree-program/>) for those who already have a bachelor's degree in another field, and the RN to B.S.N. (<https://www.nursing.psu.edu/rn-to-bsn-degree-program/>) for RNs who wish to complete the B.S.N. degree.

The master's programs include an M.S.N. program (<https://www.nursing.psu.edu/nurse-practitioner-program/>) with five options for advanced nursing roles. There are three advanced nursing practice options: Family/Individual Across the Lifespan, Adult Gerontology Primary Care Nurse Practitioner, and Adult Gerontology Acute Care Nurse Practitioner. Two options—Nurse Administrator (<https://www.nursing.psu.edu/nurse-administrator/>) and Nurse Educator (<https://www.nursing.psu.edu/nurse-educator/>)—are offered fully online through Penn State World Campus (<http://www.worldcampus.psu.edu/degrees-and-certificates/nursing-masters/overview/>). In addition, there are two post baccalaureate Certificate programs and one post-master's Certificate program offered online via the Penn State World Campus. There is also a B.S.N.–Ph.D. program (<https://www.nursing.psu.edu/bsn-to-phd-degree-program/>) that incorporates an M.S. degree as preparation for the Ph.D.

The interdisciplinary Ph.D. program (<https://www.nursing.psu.edu/ph-d-degree-program/>) in Nursing, dual-title Ph.D. in Nursing and Bioethics (<https://www.nursing.psu.edu/ph-d-in-nursing-and-bioethics-degree-program/>) and dual-title Ph.D. in Nursing and Clinical and Translational Sciences (<https://www.nursing.psu.edu/ph-d-in-nursing-and-clinical-translational-science-degree-program/>) are designed to develop clinical scholars, faculty, and researchers who can teach and provide leadership through scientific inquiry and innovative practice.

The Doctor of Nursing Practice (D.N.P.) program (<https://www.nursing.psu.edu/dnp-degree-program/>) prepares nurse leaders with a professional, practice-focused doctoral degree designed to prepare highly qualified advanced nurse clinicians to be leaders and deliver expert nursing care and ultimately improve health care outcomes. This degree is designed for nurses who plan to continue in a practice role, and have already received a bachelor's or master's degree with a major in nursing. Offered online through Penn State World Campus (<http://www.worldcampus.psu.edu/>), the program also requires two in-person intensives.

MORE INFORMATION ABOUT THE COLLEGE (<https://www.nursing.psu.edu/>)

Mission and Goals

The mission of the College of Nursing is to improve healthcare for all people in the Commonwealth of Pennsylvania, the nation and the world through the development of qualified nurse leaders at all levels of practice, the development of nursing science, and the provision of nursing care to individuals, families and communities. This is accomplished through the integrated programs of nursing, education, research, scholarship and outreach.

Accreditation

The Bachelor of Science in Nursing, Master of Science in Nursing, Master of Science (nursing) and Doctor of Nursing Practice Degree Programs are accredited by:

Commission on Collegiate Nursing Education (CCNE)
655 K Street, NW
Suite 750
Washington, DC 20001
202-887-6791 - Phone
202-887-8476 – Fax
<http://www.aacnursing.org/CCNE> (<http://www.aacnursing.org/CCNE/>)

Resources

Academic Advising

All students are assigned an academic faculty adviser and a graduate adviser once admitted to the program. The University Park/World Campus Academic Advising office is located in 203 Nursing Sciences Building and can be reached by calling (814)-863-2211 or emailing nursgrad@psu.edu.

Diversity and Inclusion Initiatives

The faculty and staff of the College of Nursing value and are committed to fostering diversity in the classroom, the University, and the profession. By respecting differences in culture, age, gender, gender expression, race, ethnicity, national origin, differing abilities, sexual orientation, and religious affiliation, we enrich the learning environment; improve the practice and profession of Nursing; and enhance personal creativity and professional growth.

The College of Nursing's Office for Diversity and Inclusion Initiatives fosters a welcoming and inclusive community while promoting and enhancing the diversity of the College's students, faculty, and staff. We support the College's efforts related to recruitment, retention, development and graduation of underrepresented students in Nursing. The office can be reached at (814) 863-6207.

Beta Sigma Chapter, Sigma Theta Tau International

Sigma Theta Tau International, today known as Sigma, is the international honor society for nursing. The purposes of Sigma are to recognize superior achievement, recognize the development of leadership qualities, foster high professional standards, encourage creative work, and strengthen commitment to the ideals and purposes of the profession.

The Pennsylvania State University's Beta Sigma Chapter was chartered in 1974. For acceptance of into Beta Sigma Chapter, graduate students must have a 3.5 GPA and demonstrated superior scholastic achievement and potential for professional leadership. Invitations for membership are given out during the year of graduation. The induction ceremony into Sigma is held during the Spring Semester.

MORE INFORMATION (<https://www.sigmanursing.org/advance-elevate/research/research-grants/>)

Doctoral Student Organizations (DSO)

The purpose of the College of Nursing Doctoral Student Organizations (Ph.D. DSO and D.N.P. DSO) is to support the academic achievement and enhance the academic environment of doctoral students throughout their enrollment at Penn State by providing a forum for collegial support, free exchange of ideas, and discussion of critical issues related to the respective doctoral programs.

All students enrolled in the Ph.D. or D.N.P. program are members of the respective DSO. There are no financial obligations related to membership. Each DSO is facilitated by one College of Nursing graduate faculty member and led by doctoral students. Meetings, held four times during the academic year, are scheduled and directed by student leaders.

Center for Nursing Research

The Center for Nursing Research provides faculty and graduate students with consulting services on quantitative and analytic approaches, assistance with grant proposal, mock grant reviews, and proposal submissions.

MORE INFORMATION (<https://www.nursing.psu.edu/center-for-nursing-research/>)

Study Abroad

Graduate student opportunities for international experiences are varied and are planned collaboratively with other units in the University. International experiences also can be arranged through Global Penn State.

MORE INFORMATION (<https://www.nursing.psu.edu/study-abroad/>)

Contact

Lisa Kitko

Associate Dean for Graduate Education and Research
College of Nursing
203 Nursing Sciences Building
University Park, PA 16802
814-863-2228
nursgrad@psu.edu

<http://www.nursing.psu.edu/>

Smeal College of Business

About the College

Charles H. Whiteman, John and Becky Surma Dean, Smeal College of Business

The Penn State Smeal College of Business is a vibrant intellectual community offering highly ranked undergraduate, graduate, doctoral, and executive education opportunities to more than 6,000 students from across the country and around the world. Since our formation in 1953, we have prepared more than 85,000 students for professional success, annually adding to Penn State's vast alumni network. We are a destination of choice for top global organizations seeking talent that will make a positive difference. Through our leading faculty and network of research centers and institutes, we are a source of knowledge that influences the business practices of tomorrow. As part of its professional graduate portfolio, the Smeal College of Business offers the Penn State Smeal M.B.A. (resident), the Penn State Smeal Executive M.B.A. (executive), and the Penn State Online M.B.A. led by the Smeal College of

Business (online). We are forging connections, creating opportunities, and producing results.

MORE INFORMATION ABOUT THE COLLEGE (<http://www.smeal.psu.edu/about-smeal/>)

Mission and Goals

As an extension of the core values of the University, the Smeal College of Business is committed to a set of strategic priorities including delivering extraordinary educational experiences, conducting research with impact, fostering a culture that prioritizes integrity, embraces unique ideas and strengthens connections via diversity enhancement initiatives and programs, and promotes sustainability in education, research, and business practice.

MORE INFORMATION (<http://www.smeal.psu.edu/about-smeal/>)

Departments

Department of Accounting

Accounting faculty are engaged in a robust range of research topics including disclosure regulation, executive compensation, credit ratings, and tax policy.

MORE INFORMATION (<https://www.smeal.psu.edu/accounting/>)

Department of Finance

Finance faculty provide research and teaching expertise in a variety of areas emphasizing corporate finance, international finance, investment management, and financial services. Smeal has built an international reputation for financial research, especially in the areas of corporate financial policy and the operation and regulation of securities markets.

MORE INFORMATION (<https://www.smeal.psu.edu/finance/>)

Department of Management and Organization

Management faculty address modern business challenges, including new organizational design such as self-managing teams and multi-firm collaborative networks. Faculty are also exploring creative ways of thinking about a firm's strategies and management processes that involve new methods of performance management, talent management, and ethical leadership.

MORE INFORMATION (<https://www.smeal.psu.edu/management/>)

Department of Marketing

Marketing faculty combines rigorous and relevant research with an approach to education that is grounded in the fundamentals while embracing leading-edge concepts and tools.

MORE INFORMATION (<https://www.smeal.psu.edu/marketing/>)

Department of Risk Management

The research and disciplinary focus of the department is on risk assessment, mitigation, and management, connecting disciplines such as actuarial science, business law, decision analysis, insurance, international business, and real estate. The department also works closely with the Institute for Real Estate Studies to promote education, scholarship, and outreach in the area of real estate.

MORE INFORMATION (<https://www.smeal.psu.edu/risk-management/>)

Department of Supply Chain and Information Systems

The department's faculty pursue both theoretical and applied research, often working closely with research centers within the college and collaborating with colleagues in other disciplines or in industry.

MORE INFORMATION (<https://www.smeal.psu.edu/scis/>)

Resources

Professional Graduate Programs

The Penn State Smeal College of Business delivers a flexible portfolio of graduate degrees and certificates to help students advance in their careers. Smeal offers an assortment of one-year residential specialty masters programs, three MBA programs, and a range of online specialty masters and certificates.

MORE INFORMATION (<http://www.smeal.psu.edu/pgp/>)

Ph.D. Program

The doctoral program in the Penn State Smeal College of Business enrolls a limited number of candidates each year. The program is designed to prepare students for academic careers and offers numerous areas of emphasis.

MORE INFORMATION (<http://www.smeal.psu.edu/phd/>)

Contact

Brian Cameron

Associate Dean, Professional Graduate Programs
220 Business Building
University Park PA, 16802
814-863-0474
bcameron@psu.edu

Brent Ambrose

Director of the Ph.D. Program
351 Business Building
University Park PA, 16802
814-865-7669
bwa10@psu.edu

General Information

The General Information section in the Graduate Bulletin is designed to give you an overview of the purpose and features of the bulletin, answer frequently asked questions about the bulletin, and provide information about the University structure and leadership. In addition to the information found in this area and on graduate major degree program pages, graduate education policies can be found on the Graduate School website (<http://gradschool.psu.edu/graduate-education-policies/>).

Click on topics of interest below or the tabs to the right to explore different information areas. In addition, the General Information section can be accessed from any page in the Bulletin from the navigation bar.

About Penn State (p. 34)

Using this Bulletin (p. 38)

Transcripts (p. 43)

About Penn State

This is Penn State

Penn State is in the top 1 percent of universities worldwide and has the largest alumni network in the nation. Founded in 1855, the University combines academic rigor with a vibrant campus life as it carries out its mission of teaching, research, and service with pride and focuses on the future throughout Pennsylvania and the world. Granted the highest rating for research universities by the Carnegie Foundation, Penn State teaches students to be leaders with a global perspective.

Our leadership in administration, faculty, and staff make our mission come alive every day. The Board of Trustees reviews and approves the budget of the University and guides general goals, policies, and procedures from a big-picture perspective. The President's office ensures that all aspects of the University are running smoothly and promotes overall principles that students, faculty, and staff abide by for the long term. The University Faculty Senate represents the Penn State faculty with legislative authority on all matters regarding the University's educational interests.

Penn State strives to celebrate diversity in all aspects of its educational and operational activities and the University's strategic plans are designed to result in ongoing improvements that help prepare future generations of leaders.

Board of Trustees

The Board of Trustees of The Pennsylvania State University is the corporate body established by the charter with complete responsibility for the government and welfare of the University and all the interests pertaining thereto including students, faculty, staff, and alumni.

In the exercise of this responsibility, the Board is guided by the following policies:

1. The authority for day-to-day management and control of the University, and the establishment of policies and procedures for the educational program and other operations of the University, shall be delegated to the President, and by him/her, either by delegation to or consultation with the faculty and the student body in accordance with a general directive of the Board.

This delegation of authority requires that the Board rely on the judgment and decisions of those who operate under its authority. However, this reliance of the Board must be based upon its continuing awareness of the operations of the University. Therefore, the Board shall receive and consider thorough and forthright reports on the affairs of the University by the President or those designated by the President. It has a continuing obligation to require information or answers on any University matter with which it is concerned.

Finally, upon request, the Board shall advise the President on any University matter of concern to him/her.

2. The Board of Trustees shall carry out certain responsibilities as a Board, without delegation. These responsibilities are:
 - a. The selection of the President of the University
 - b. The determination of the major goals of the University and the approval of the policies and procedures for implementation of such goals.
 - c. The review and approval of the operating and capital budget of the University.

- d. Such other responsibilities as law, governmental directives, or custom require the Board to act upon.
- 3. The Board of Trustees shall inform the citizens of the Commonwealth of Pennsylvania of the University's performance of its role in the education of the youth of Pennsylvania.
- 4. The Board of Trustees shall assist the President in the development of effective relationships between the University and the various agencies of the Commonwealth of Pennsylvania and the United States of America which provide to the University assistance and direction.

MORE INFORMATION ABOUT THE BOARD OF TRUSTEES (<https://trustees.psu.edu/>)

President's Council

- Neeli Bendapudi, President (<https://www.psu.edu/president/>)
- Tracy Langkilde, Interim Executive Vice President and Provost (<https://provost.psu.edu/>)
- Jeff Adams, Interim Vice Provost and Dean for Undergraduate Education (<https://undergrad.psu.edu/>)
- Kathleen Bieschke, Vice Provost for Faculty Affairs (<https://vpfa.psu.edu/>)
- Margo E. DelliCarpini, Vice President for Commonwealth Campuses and Executive Chancellor (<https://www.campuses.psu.edu>)
- Andrea Dowhower, Interim Vice President for Student Affairs (<https://studentaffairs.psu.edu>)
- Shannon S. Harvey, Assistant Vice President and Secretary to the Board of Trustees (<https://trustees.psu.edu/>)
- Karen Kim, Dean, College of Medicine (<https://med.psu.edu>)
- Patrick Kraft, Vice President for Intercollegiate Athletics (<https://gopsusports.com>)
- David Lieb, Interim Vice President for Development (<https://raise.psu.edu/>) and Alumni Relations (<https://www.alumni.psu.edu/>)
- Chris Lucas, Acting Interim Vice President for Information Technology/Chief Information Officer (<https://www.it.psu.edu/>)
- Stephen M. Massini, Chief Executive Officer, Penn State Health (<https://www.pennstatehealth.org/locations/milton-s-hershey-medical-center/>)
- Matt Melvin, Vice President for Enrollment Management (<https://em.psu.edu/>)
- Tabitha R. Oman, Vice President and General Counsel (<https://www.ogc.psu.edu/>)
- Rachel A. Pell, Vice President for Strategic Communications (<https://strategiccommunications.psu.edu/>)
- Andrew Read, Senior Vice President for Research (<https://www.research.psu.edu>)
- William Sitzabee, Vice President for Facilities Management and Planning (<https://www.opp.psu.edu/>)
- Michael Wade Smith, Senior Vice President and Chief of Staff (<https://chiefofstaff.psu.edu/>)
- Allan G. Sonsteby, Executive Director of the Applied Research Laboratory (<https://www.arl.psu.edu/>)
- Michael D. Stefan, Vice President for Government and Community Relations (<https://www.govt.psu.edu>)
- Larry D. Terry II, Vice President for Outreach (<https://www.outreach.psu.edu>)

- Sara Thorndike, Senior Vice President for Finance and Business/Treasurer (<https://fandb.psu.edu/>)
- Marcus A. Whitehurst, Vice Provost for Educational Equity (<http://equity.psu.edu>)
- Jennifer R. Wilkes, Vice President for Human Resources (<https://hr.psu.edu/>) and Chief Human Resources Officer

MORE INFORMATION ABOUT UNIVERSITY LEADERSHIP (<https://www.psu.edu/this-is-penn-state/leadership/>)

Mission

The Pennsylvania State University is a multi-campus, land-grant, public research University that educates students from around the world, and supports individuals and communities through integrated programs of teaching, research, and service.

Our instructional mission includes undergraduate, graduate, professional, continuing, and extension education, offered through both resident instruction and distance learning. Our educational programs are enriched by the talent, knowledge, diversity, creativity, and teaching and research acumen of our faculty, students, and staff.

Our discovery-oriented, collaborative, and interdisciplinary research and scholarship promote human and economic development, global understanding, and advancement in professional practice through the expansion of knowledge and its applications in the natural and applied sciences, social and behavioral sciences, engineering, technology, arts and humanities, and myriad professions.

As Pennsylvania's land-grant university, we provide unparalleled access to education and public service to support the citizens of the Commonwealth and beyond. We engage in collaborative activities with private sector, educational, and governmental partners worldwide to generate, integrate, apply, and disseminate knowledge that is valuable to society.

History

As Pennsylvania's only land-grant university, Penn State has a broad mission of teaching, research, and public service. But that mission was not so grandly conceived in 1855, when the Commonwealth chartered it as one of the nation's first colleges of agricultural science, with a goal to apply scientific principles to farming.

Centre County became the site of the new college in response to a gift of 200 acres from gentleman farmer and ironmaster James Irvin of Bellefonte. Founding President Evan Pugh drew on the scientific education he had received in Europe to plan a curriculum that combined theoretical studies with practical applications.

Pugh and similar visionaries in other states championed Congressional passage of the Morrill Land-Grant Act in 1862. The act enabled states to sell federal land, invest the proceeds, and use the income to support colleges "where the leading object shall be, without excluding scientific and classical studies ... to teach agriculture and the mechanic arts [engineering] ... in order to promote the liberal and practical education of the industrial classes in all the pursuits and professions of life." The state legislature designated Penn State the land-grant institution of Pennsylvania.

But not until the 1880s, under the leadership of President George W. Atherton, did the college expand its curriculum to match the Land-Grant Act's broad mandate. From that time onward, curricula in engineering, the

sciences, the liberal arts, and more began to flourish. In the early 1900s, Penn State introduced cooperative extension and additional outreach programming, extending the reach of its academic mission.

An even greater segment of the Commonwealth's population had opportunities for engagement in the 1930s when Penn State established a series of undergraduate branch campuses, primarily to meet the needs of students who were location-bound during the Great Depression. Those campuses were predecessors of today's system of 24 Penn State campuses located throughout the Commonwealth.

Penn State began offering systematic advanced-degree work in 1922 with the formation of the Graduate School. Graduate education and research evolved hand in hand. By 1950 the University had won international distinction for investigations in dairy science, building insulation, diesel engines, and acoustics, and other specialized fields.

A college of medicine and teaching hospital were established in 1967 with a \$50 million gift from the charitable trusts of renowned chocolate magnate Milton S. Hershey. In 1989 the Pennsylvania College of Technology in Williamsport became an affiliate of the University. Penn State's online World Campus graduated its first students in 2000 and now enrolls more than 12,000. Also in 2000, Penn State and the Dickinson School of Law merged. In 2015, two Penn State law schools, Dickinson Law (in Carlisle, Pennsylvania) and Penn State Law (on University Park campus) were established.

MORE INFORMATION ABOUT UNIVERSITY HISTORY (<https://www.psu.edu/this-is-penn-state/history/>)

Accreditation Notice

The Pennsylvania State University is accredited by the Middle States Commission on Higher Education (<https://www.msche.org>), 3624 Market Street, Philadelphia, PA 19104 (267-284-5000). The Middle States Commission on Higher Education (MSCHE) is an institutional accrediting agency recognized by the U.S. Secretary of Education and the Council for Higher Education Accreditation.

The Pennsylvania State University was first accredited in 1921 and accreditation was reaffirmed in June 2015.

Annual Institutional Updates are submitted each spring-summer. The last Midpoint Peer Review occurs every four years and last occurred in 2020. The next Self-Study evaluation is scheduled for 2023-2024.

According to MSCHE's policy statement, Accreditation Review Cycle and Monitoring, "The Commission's eight-year cycle of review of accredited institutions begins with an in-depth institutional self-study that is reviewed by peer evaluators during an on-site evaluation visit. The self-study and on-site review are used to assess the institution's compliance with Commission standards and requirements of affiliation, verify compliance with accreditation-relevant federal regulations, and identify areas needing improvement. The review process results in an accreditation decision in accordance with the Commission Policy Accreditation actions. Institutions submit annually an update of institutional data and other information requested by the Commission. In the fourth year following the self-study visit, the Commission conducts an off-site mid-point peer review based on the cumulative information provided by the institution. Institutions are provided a report on the institution's performance with respect to student achievement and financial sustainability."

MORE INFORMATION ABOUT THE ACCREDITATION REVIEW CYCLE (<https://msche.my.salesforce.com/sfc/p/>)

MORE INFORMATION ABOUT ACCREDITATION BY THE MIDDLE STATES COMMISSION ON HIGHER EDUCATION (<https://opair.psu.edu/accreditation/>)

Research

The Office of the Vice President for Research is responsible for facilitating the \$863-million-per-year research enterprise at Penn State by working with a broad range of units across the University.

The mission of the Office of the Vice President for Research is to support a rigorous program of faculty and student research and creative accomplishment by enhancing the environment for scholarly and artistic endeavors, encouraging the highest standards of quality, and fostering ethical conduct in research.

The office is responsible for:

- the effective administration of sponsored programs which provide the financial support for a substantial share of the research activity at the University;
- serving as the University's advocate and spokesperson on research issues, and as a representative in activities that may produce major new programs and facilities for research;
- facilitating strong programs for interdisciplinary research.

MORE INFORMATION ABOUT RESEARCH AT PENN STATE (<https://www.research.psu.edu/>)

University Structure

Undergraduate Campuses

Penn State has more than twenty campuses across Pennsylvania that serve undergraduate students and communities through teaching, research, and service. Through its network of undergraduate campuses and World Campus, Penn State provides students the opportunity to begin and complete a Penn State degree at one campus, transition to complete a degree at another campus or complete a program completely online—this is the hallmark of Penn State's unique one University concept.

The University Park campus, the administrative and research hub of the University is the largest of Penn State's campuses. Across Pennsylvania, Penn State campuses play a critical role in the land-grant mission of the University, by providing access and opportunity—a commitment that remains at the core of each campus's mission. In addition to providing the first two years of more than 160 Penn State majors, campuses confer nearly 5,000 Penn State degrees annually to students who complete their academic programs at a Penn State campus.

MORE INFORMATION ABOUT UNDERGRADUATE CAMPUSES (<https://bulletins.psu.edu/undergraduate/campuses/>)

Graduate and Professional Campuses

Penn State's wide range of graduate programs includes traditional residential Ph.D. research programs through part-time degree programs aimed at working professionals. Penn State offers graduate programs at six campuses: Penn State Erie, Penn State Great Valley, Penn State Harrisburg, Penn State College of Medicine, Penn State University Park, and Penn State World Campus. Penn State College of Medicine in Hershey, PA offers a complete medical education program leading to

the Doctor of Medicine (M.D.) degree. Penn State has two separately accredited Law Schools: Dickinson Law in Carlisle, PA and Penn State Law at University Park.

MORE INFORMATION ABOUT GRADUATE AND PROFESSIONAL CAMPUSES (p. 10)

Colleges

Penn State's undergraduate majors are divided among academic colleges, which are the units from which students receive their degrees. Examples of colleges are Arts and Architecture, Eberly College of Science, and Education, among others. Academic colleges offer graduate programs as well; however, graduate degrees are awarded by the Graduate School. In addition to the 12 academic colleges at the University Park campus, Penn State has six academic colleges across Pennsylvania that allow students to finish their undergraduate degrees at a campus other than University Park.

With the exception of a few specialized programs, undergraduate students interested in majors offered by the above academic colleges can start their education at any Penn State campus and then transition to University Park following their second year to complete their degree as part of the 2+2 Plan.

In addition, the Pennsylvania College of Technology in Williamsport offers undergraduate enrollments in selected degree programs.

For a list of academic colleges, enrollment units, and special academic programs visit the Undergraduate Bulletin Colleges (<https://bulletins.psu.edu/undergraduate/colleges/>) page.

Academic Colleges at Campuses

Six Penn State colleges, located throughout the state, offer undergraduate majors that are typically completed at campuses other than University Park. These colleges are:

- Abington College, at the Penn State Abington campus
- Altoona College, at the Penn State Altoona campus
- Behrend College, at the Penn State Erie campus
- Berks College, at the Penn State Berks campus
- Capital College, at the Penn State Harrisburg campus
- University College, is comprised of the following 14 campuses:
 - Penn State Beaver
 - Penn State Brandywine
 - Penn State DuBois
 - Penn State Fayette, The Eberly Campus
 - Penn State Greater Allegheny
 - Penn State Hazleton
 - Penn State Lehigh Valley
 - Penn State Mont Alto
 - Penn State New Kensington
 - Penn State Schuylkill
 - Penn State Shenango
 - Penn State Wilkes-Barre
 - Penn State Scranton
 - Penn State York

Students interested in undergraduate majors offered by these colleges can typically start at one campus and finish at another through the 2+2 plan, or they can choose to stay at one campus for all four years if

their campus of choice offers the major they want. To see the specific undergraduate majors available at each campus, search majors by campus in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>).

Student Services and Programs

Penn State offers thousands of resources to support students, faculty, staff, and alumni both locally and around the world. This partial list of centers, offices, and programs was developed based on past inquiries from Bulletins users.

To discover additional services explore Penn State's home page (<https://www.psu.edu/>), the Office of Student Affairs (<https://studentaffairs.psu.edu/>), and the Office of Undergraduate Education (<https://undergrad.psu.edu/>), and The Graduate School (<https://gradschool.psu.edu/>).

- Affirmative Action Office (<https://affirmativeaction.psu.edu/>)
- Adult Learner Programs & Services (<https://studentaffairs.psu.edu/adults/>)
- Campus Recreation (<https://studentaffairs.psu.edu/campusrec/>)
- Career Services (<https://studentaffairs.psu.edu/career/>)
- Child Care Resources (<https://hr.psu.edu/employee-and-family-resources/your-family/child-care-resources/>)
- Counseling and Psychological Services (<https://studentaffairs.psu.edu/counseling/>)
- Disability Services Resources (<http://equity.psu.edu/student-disability-resources/>)
- Spiritual and Ethical Development, Center for (<https://studentaffairs.psu.edu/spiritual/>)
- Financial Literacy and Wellness Center (<https://financialliteracy.psu.edu/>)
- Fraternity and Sorority Life (<https://studentaffairs.psu.edu/greeks/>)
- Gender Equity Center (<https://studentaffairs.psu.edu/genderequity/>)
- Global Programs, Office of (<https://global.psu.edu/>)
- Graduate Educational Equity Programs, Office of (<https://gradschool.psu.edu/diversity/>)
- Graduate Writing Center (<https://gwc.psu.edu/>)
- Health Services (<https://studentaffairs.psu.edu/health/>)
- Information Technology at Penn State (<https://www.it.psu.edu/>)
- Multicultural Resource Center (<http://equity.psu.edu/mrc/>)
- Off-Campus Student Support (<https://studentaffairs.psu.edu/offcampus/>)
- Outreach and Online Education (<https://www.outreach.psu.edu/>)
- Paul Robeson Cultural Center (<https://studentaffairs.psu.edu/cultural/>)
- Penn State Learning (<https://pennstatelearning.psu.edu/>)
- Residence Life (<https://studentaffairs.psu.edu/reslife/>)
- Sexual and Gender Diversity, Center for (<https://studentaffairs.psu.edu/csgd/>)
- Student Affairs, Office of (<https://studentaffairs.psu.edu/>)
- Student Care & Advocacy (<https://studentaffairs.psu.edu/studentcare/>)
- Undergraduate Research and Fellowships Mentoring (<https://urfm.psu.edu/>)
- Student Accountability and Conflict Response, Office of (<https://studentaffairs.psu.edu/student-accountability/>)

- Student Organization Directory (<https://studentaffairs.psu.edu/get-involved/student-organizations/>)
- Summer Session (<https://summersession.psu.edu>)
- Veterans Programs, Office of (<http://equity.psu.edu/veterans/>)
- University Libraries (<https://libraries.psu.edu/>)

Using this Bulletin

Introduction

The Graduate Bulletin is Penn State's comprehensive source for graduate academic information and program requirements.

New Features

Program Page Layout

- Consistent layout of graduate major degree program information organized within the following tabs:
 - Overview (including the Program Code and Campus)
 - Admission Requirements
 - Degree Requirements
 - Dual-Titles (if any)
 - Integrated Undergrad-Grad Program (if any)
 - Joint Degrees (if any)
 - Student Aid
 - Courses
 - Learning Outcomes
 - Contact

Please note that the University may make changes to policies, procedures, educational offerings, and requirements.

Changes Page

- Real-time amendments to information in the Bulletin will be tracked on the Changes page.
- The Bulletin is updated every semester. The Bulletin Archive (<http://undergraduate.bulletins.psu.edu/undergraduate/archive/>) contains previous versions of graduate program information.

Course Bubble

When a course link is clicked, a course bubble will appear with important course information including, but not limited to:

- course title, description, and credits;
- prerequisites and recommended preparation;
- if the course is repeatable;
- if the course is cross-listed.

Nondiscrimination Statement

The University is committed to equal access to programs, facilities, admission and employment for all persons. It is the policy of the University to maintain an environment free of harassment and free of discrimination against any person because of age, race, color, ancestry, national origin, religion, creed, service in the uniformed services (as defined in state and federal law), veteran status, sex, sexual orientation, marital or family status, pregnancy, pregnancy-related conditions, physical or mental disability, gender, perceived gender, gender identity, genetic information or political ideas. Discriminatory conduct and harassment, as well as sexual misconduct and relationship violence, violates the dignity of individuals, impedes the realization of the University's educational mission, and will not be tolerated. Direct all

inquiries regarding the nondiscrimination policy to the Affirmative Action Office, The Pennsylvania State University, 328 Boucke Building, University Park, PA 16802-5901, Email: aao@psu.edu, Tel (814) 863-0471.

Academic Authority

The Graduate Council has responsibility for, and authority over, all academic information contained in the Graduate Bulletin.

Each step of the educational process, from admission through graduation, requires continual review and approval by University officials. The University, therefore, reserves the right to change the requirements and regulations contained in this Bulletin and to determine whether a student has satisfactorily met its requirements for admission or graduation, and to reject any applicant for any reason the University determines to be material to the applicant's qualifications to pursue higher education.

MORE INFORMATION ABOUT ACADEMIC AUTHORITY (<http://gradschool.psu.edu/gradcouncil/>)

Definitions and Abbreviations

Described below are definitions related to graduate major degree programs:

Graduate / Postbaccalaureate Certificate Program

A graduate or postbaccalaureate credit certificate program is a group of courses that focuses upon an area of specialized knowledge or information and is developed, supervised, and evaluated by the faculty members of the academic unit offering the program. Postbaccalaureate credit certificate programs reflect emerging academic areas, and may supplement or enhance existing degree programs. Postbaccalaureate certificates and graduate certificates differ in the number of graduate credits required; see the Postbaccalaureate Credit Certificate Programs policy (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/postbaccalaureate-credit-certificate-programs/>) for more details.

Graduate Dual-Title Degree Program

A dual-title program is a fully integrated program of study that integrates course work and research in the graduate major and dual-title fields early in the student's program. Dual-title programs are adopted by existing graduate major programs; after entering those graduate major programs, students can apply to the dual-title and earn a degree in both their graduate major and the dual-title field. See the Dual-Title Graduate Degree Program policy (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/dual-title-graduate-degree-programs/>) for more details.

Graduate Joint Degree Program

A joint degree program allows students to pursue work simultaneously towards an existing, specific graduate degree and a professional degree (J.D. or M.D.) offered at Penn State. Joint degree programs enhance students' educational and research opportunities within the graduate and professional programs, provide students with valuable complementary training for a variety of career opportunities, and enable students to complete both degrees in less time than it would take to complete them separately. See the Joint Degree Programs policy (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/joint-degree-programs/>) for more details.

Graduate Minor Program

A graduate minor may be taken in any of the approved graduate major degree programs. In addition, there are stand-alone graduate minors which are unaffiliated with a graduate major. Graduate minors are available for both master's and doctoral degrees; see the following Graduate Minors policies for more details: Minor - Research Doctorate (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/minor-research-doctorate/>), Minor - Professional Doctoral Degrees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/doctoral-minor-professional-doctorate/>), Minor - Research Master's Degrees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/minor-research-masters/>), Minor - Professional Master's Degrees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/minor-professional-masters/>).

Integrated Undergraduate-Graduate (IUG) Degree Program

An Integrated Undergraduate-Graduate (IUG) degree program combines a Penn State baccalaureate degree with a master's degree as a continuous program of study. An IUG program allows qualifying students to:

- create a cohesive plan for baccalaureate and master's degree studies, with advising informed by requirements for both degree programs;
- complete the combined degree program in less time than it would take to complete each program separately;
- become familiar with the expectations of graduate studies in their programs;
- access the resources of the Graduate School; and
- learn from current graduate students who share academic interests.

See the Integrated Undergraduate-Graduate (IUG) Degree Programs policy (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/integrated-undergraduate-graduate-degree-programs/>) for more details.

Option

An option is a distinct curricular specialization within a graduate major. It is the only formal curricular specialization within a graduate major that is recognized on the transcript and diploma for students in the major. Options are defined by certain minimum requirements related to the distinctiveness and commonality of the course work in the major; see the Degree Program Options policy (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/degree-program-options/>) for more details.

Abbreviations, Acronyms, and Codes

Described below are common codes, abbreviations, acronyms, and other types of academic shorthand used at Penn State, along with a brief explanation of each.

Code	Explanation
A	Special topics (course suffix; indicates different versions of the same course, e.g., CAS 100A, CAS 100B, CAS 100C)
A & A	Arts and Architecture (college abbreviation)
AA	Arts and Architecture (college code)
AAPPM	Academic Administrative Policies and Procedures Manual

AB	Abington (campus code)
AB	Abington (college code)
ACUE	Administrative Council on Undergraduate Education
AG	Agricultural Sciences (college code)
AL	Altoona (campus code)
AL	Altoona (college code)
AP	Advanced Placement Program
APPL	Course requires an application with the School of Music (course characteristic)
APPT	By appointment (class meeting time)
AU	Audit, attended regularly (grade reporting symbol)
AUDN	Course requires an audition (course characteristic)
AUU	Audit, did not attend regularly (grade reporting symbol)
B	Special topics (course suffix; indicates different versions of the same course, e.g., CAS 100A, CAS 100B, CAS 100C)
BA	Business, Smeal College of (college code)
BC	Behrend (college code)
BK	Berks (campus code)
BK	Berks (college code)
BR	Beaver (campus code)
BW	Brandywine (campus code)
C	Special topics (course suffix; indicates different versions of the same course, e.g., CAS 100A, CAS 100B, CAS 100C)
CA	Capital (college code)
CALC	Course requires a calculator (course characteristic)
CAMP	College Assistance Migrant Program
CAT	Online catalog, University Libraries
CC	Commonwealth Campuses
CCP	College Contact Person
CCRR	College Contact and Referral Representative
CCSG	Council of Commonwealth Student Governments
CE	Continuing Education
CGPA	Cumulative grade-point average
CIC	Committee on Institutional Cooperation
CLEP	College-Level Examination Program
CM	Communications (college code)
CNCR	Course is scheduled concurrently with another course (course characteristic)

CNTL	Course is controlled (course characteristic)	GA	Greater Allegheny (campus code)
COMM	Communications (college abbreviation)	GH	Humanities (General Education code)
CORD	Course is coordinated with other course(s) (course characteristic)	GHW	Health and Wellness (General Education code)
COST	Course requires an additional fee (course characteristic)	GN	Graduate non-degree (college code)
D	Special topics (course suffix; indicates different versions of the same course, e.g., HIST 297D, HIST 297E)	GN	Natural Sciences (General Education code)
DAA	Dean/Director of Academic Affairs	GPA	Grade-point average
DF	Deferred grade (grade reporting symbol)	GQ	Quantification (General Education code)
DN	Dickinson School of Law (campus code)	GR	Graduate (level code)
DS	DuBois (campus code)	GR ND	Graduate non-degree (college code)
DU	Division of Undergraduate Studies (college code)	GS	Social and Behavioral Sciences (General Education code)
D U S	Division of Undergraduate Studies (college abbreviation)	GV	Great Valley (campus code)
E	Special topics (course suffix; indicates different versions of the same course, e.g., HIST 297D, HIST 297E)	GV	Great Valley (college code)
ECoS	Eberly College of Science	GWS	Writing/Speaking (General Education code)
ED	Education (college code)	H	Honors course or section (course suffix)
EM	Earth and Mineral Sciences (college code)	HB	Harrisburg (campus code)
EM SC	Earth and Mineral Sciences (college abbreviation)	H H D	Health and Human Development (college abbreviation)
EN	Engineering (college code)	HH	Health and Human Development (college code)
ENGR	Engineering (college abbreviation)	HN	Hazleton (campus code)
EOP	Educational Opportunity Program	HY	Hershey Medical Center (campus code)
EPR	Early Progress Report	I	Incomplete (grade reporting symbol)
EPS	Educational Planning Survey	I	Special topics (course suffix; indicates different versions of the same course, e.g., HIST 297I, HIST 297K)
ER	Behrend (campus code)	I COL	Intercollege programs (college abbreviation)
ESL	English as a Second Language	IB	International Baccalaureate Program
EVEX	Course has evening exams (course characteristic)	IC	Intercollege programs (college code)
F	Special topics (course suffix; indicates different versions of the same course, e.g., HIST 297F, HIST 297G)	IL	International Cultures (General Education code)
FE	Fayette (campus code)	INCP	Incomplete (grade reporting symbol)
FINL	Course has a final exam (course characteristic)	INTG	Course is integrated with other courses (course characteristic)
FL	Failure under pass/fail option (grade reporting symbol)	IS	Information Sciences and Technology (college code)
FYS	First-Year Seminar	IST	Information Sciences and Technology (college abbreviation)
G	Special topics (course suffix; indicates different versions of the same course, e.g., HIST 297F, HIST 297G)	ITS	Information Technology Services
GA	Arts (General Education code)	IUG	Integrated undergraduate/graduate degree programs
		IVID	Course uses interactive video (course characteristic)

J	Individualized instruction (course suffix)	ROTC	Reserve Officers' Training Corps
K	Special topics (course suffix; indicates different versions of the same course, e.g., HIST 297I, HIST 297K)	S	First-Year Seminar (course suffix)
L	Lecture section (course suffix)	SA	Satisfactory achievement (grade reporting symbol)
LA	Liberal Arts (college code)	SATL	Course is offered at multiple locations via satellite uplink (course characteristic)
LEAP	Learning Edge Academic Program	SC	Science, Eberly College of (college code)
LIAB	Course has liability attendance policy (course characteristic)	SCIEN	Science, Eberly College of (college abbreviation)
LV	Lehigh Valley (campus code)	SEGM	Course is segmented (course characteristic)
LW	Law (level code)	SGPA	Semester grade-point average
M	Writing Across the Curriculum and Honors (course suffix)	SH	Shenango (campus code)
MA	Mont Alto (campus code)	SI	Supplemental Instruction
MAC	Morgan Academic Center (for Student-Athletes)	SITE	Schreyer Institute for Teaching Excellence
MD	Medical (level code)	SL	Schuylkill (campus code)
MD	Medicine (college code)	SLO	Special Living Options
MED	Medicine (college abbreviation)	SOTP	Student Orientation and Transition Programs
MEP	Multicultural Engineering Program	SRTE	Student Ratings of Teacher Effectiveness
MRC	Multicultural Resource Center	SSSP	Student Support Services Program
MS	Military Science (ROTC) (college code)	T	First-Year Seminar and Honors (course suffix)
NACADA	National Academic Advising Association	TMDT	Course has additional meeting times/dates (course characteristic)
NC	Non-credit (level code)	U	United States Cultures/International Cultures and Honors (course suffix)
NDEGR/C/H	Nondegree Regular/Conditional/High School (Classification of Undergraduate Students)	UAO	Undergraduate Admissions Office
NG	No grade (grade reporting symbol)	UC	University College (college code)
NK	New Kensington (campus code)	UE	Undergraduate Education
NR	Nursing (college code)	UFO	University Fellowships Office
NSO	New Student Orientation	UG	Undergraduate (level code)
OCLC	Course meets at an off-campus location (course characteristic)	UG ND	Undergraduate non-degree (college code)
ODS	Office for Disability Services	UN	Undergraduate nondegree (college code)
OSA	Office of Student Aid	UN	Unsatisfactory achievement (grade reporting symbol)
OUR	Office of the University Registrar	UP	University Park (campus code)
P	Pass (noncredit course) (grade reporting symbol)	UPUA	University Park Undergraduate Association
P	Practicum (or laboratory) section (course suffix)	US	United States Cultures (General Education code)
PC	Penn College (Pennsylvania College of Technology; campus code)	W	Official withdrawal (grade reporting symbol)
PREQ	Course has prerequisites (course characteristic)	W	Writing Across the Curriculum (course suffix)
PS	Pass (pass/fail option) (grade reporting symbol)	WB	Wilkes-Barre (campus code)
PSU	Pennsylvania State University	WC	World Campus
R	Recitation section (course suffix)		
R	Research (grade reporting symbol)		
RAP	Recommended Academic Plan		
RI	Resident Instruction		

WEB	Web course; offered entirely through the Internet (course characteristic)
WEP	Women in Engineering Program
WF	Withdrew failing (grade reporting symbol)
WISE	Women in the Sciences and Engineering
WN	Withdrew no grade (grade reporting symbol)
WP	Withdrew passing (grade reporting symbol)
WS	Worthington Scranton (campus code)
X	Writing Across the Curriculum and First-Year Seminar (course suffix)
XC	State College Continuing Education (campus code)
XF	Failure, academic dishonesty (course grade)
XS	Foreign studies program (campus code)
Y	Writing Across the Curriculum course and United States Cultures/ International Cultures (course suffix)
YK	York (campus code)

Common abbreviations for course attributes and suffixes can be found in the University Course Descriptions (p. 843) section.

Changes to the Graduate Bulletin

Changes to the Graduate Bulletin will be tracked in real-time and listed below. At the end of every semester, these updates will be incorporated into the Bulletin.

Program Changes Effective Summer 2024

Clinical Psychology

Change name from Applied Clinical Psychology and change degree requirements.

Computer Science

Change requirements for IUG and remove tracks.

Education, Development, and Community Engagement

Adopt dual-title in Transdisciplinary Research on Environment and Society.

Life Long Learning and Adult Education

Discontinue extension of the Master of Education (M.Ed.) to the Harrisburg campus.

Soil Science

Adopt dual-title in Transdisciplinary Research on Environment and Society.

Certificate Changes Effective Summer 2024

Ancient Languages PostBaccalaureate Credit Certificate Program

Certificate renewed.

Business Process Integration Graduate Credit Certificate Program

New certificate offering.

Cyber Threat Analytics and Prevention Graduate Credit Certificate Program

Change certificate requirements and renew.

Institutional Research Graduate Credit Certificate Program

Certificate renewed.

IT Analytics Graduate Credit Certificate Program

New certificate offering.

Principalship Graduate Credit Certificate Program

Certificate renewed.

Teacher Leadership Graduate Credit Certificate Program

Certificate renewed.

Program Changes Effective Fall 2024

Accounting (Smeal)

Change degree requirements.

Ancient Mediterranean Languages

New graduate dual-title program.

Ancient Mediterranean Studies

New graduate degree program offering the Master of Arts (M.A.) degree in residence at University Park.

Criminology

Change degree requirements.

Data Analytics

Change degree title from Master of Professional Studies (M.P.S.) to Master of Data Analytics (M.D.A.) and change degree requirements.

Education Policy and Leadership

New graduate degree program offering the Doctor of Philosophy (Ph.D.) degree in residence at University Park.

Social Work

New graduate degree program offering the Master of Social Work (M.S.W.) degree online via World Campus.

Supply Chain Management

Extend residential offering to University Park.

Certificate Changes Effective Fall 2024

Program Changes Effective Spring 2025

Certificate Changes Effective Spring 2025

FAQs

- Where can I find the Undergraduate Bulletin?
 - The Undergraduate Bulletin is located at <http://bulletins.psu.edu/undergraduate> (<http://bulletins.psu.edu/undergraduate/>).
- Where can I find a list of courses and course descriptions?
 - You may find courses and descriptions several different ways within the Bulletin. You may navigate to the full listing of courses and descriptions from the Courses (p. 843) link in the top navigation menu. You may also scroll over any course number within the Bulletin to see the course description in a course bubble. Search for specific courses through the search option on the homepage or in the search functions throughout the Bulletin.

3. Where can I find past Bulletins?
 - Past Bulletins can be found on the Archive page (p. 10), which can be accessed from any page in the Bulletin's top navigation menu.
4. When will the Graduate Bulletin be updated?
 - The Bulletin will be updated at the beginning of each semester (fall, spring, and summer). Changes that occur between updates are identified on the Changes page.
5. Why are there are some courses listed in the Bulletin that I can't schedule?
 - The Bulletin Course Description section displays all courses that are currently active at Penn State. Not all of these courses are taught every academic semester or year. To view courses that are available for enrollment by semester, please view the LionPATH Class Search (https://www.lionpath.psu.edu/psc/CSPRD/EMPLOYEE/HRMS/c/SA_LEARNER_SERVICES.CLASS_SEARCH.GBL?Page=SSR_CLSRCH_ENTRY&Action=U).

Have a question we didn't include? Please let us know by emailing bulletins@psu.edu.

Transcripts

Official Transcripts

Official transcripts are issued by the Office of the University Registrar. An official transcript is the University's certified statement of a student's academic record.

MORE INFORMATION ABOUT OFFICIAL TRANSCRIPTS (<http://www.registrar.psu.edu/transcripts/transcripts.cfm>)

Academic Advising Transcripts

Currently enrolled students may print academic advising transcripts directly from LionPATH for the purpose of on-campus academic advising.

MORE INFORMATION ABOUT ACADEMIC ADVISING TRANSCRIPTS (<http://www.registrar.psu.edu/transcripts/>)

Programs

Graduate Major Degree Programs

- Accounting (Behrend)
- Accounting (Capital)
- Accounting (Great Valley)
- Accounting (Smeal)
- Accounting Analytics
- Acoustics
- Additive Manufacturing and Design
- Aerospace Engineering
- African American and Diaspora Studies
- African Studies
- Agricultural and Biological Engineering
- Agricultural and Environmental Plant Science
- American Studies
- Anatomy
- Ancient Mediterranean Studies
- Animal Science
- Anthropology
- Applied Behavior Analysis
- Applied Linguistics
- Architectural Engineering
- Architecture
- Art
- Art Education
- Art History
- Artificial Intelligence
- Asian Studies
- Astrobiology
- Astronomy and Astrophysics
- Athletic Training
- Biobehavioral Health
- Biochemistry, Microbiology, and Molecular Biology
- Bioethics
- Biogeochemistry
- Bioinformatics and Genomics
- Biology
- Biomedical Engineering
- Biomedical Sciences
- BioRenewable Systems
- Biostatistics
- Biotechnology
- Business Administration (Behrend)
- Business Administration (Capital)
- Business Administration (Executive)
- Business Administration (Great Valley)
- Business Administration (Intercollege)
- Business Administration (Smeal)
- Business Analytics
- Chemical Engineering
- Chemistry
- Civil Engineering (Capital)
- Civil Engineering (Engineering)
- Classics and Ancient Mediterranean Studies
- Climate Science
- Clinical and Translational Sciences
- Clinical Psychology
- Clinical Research
- Communication Arts and Sciences
- Communication Sciences and Disorders
- Communications
- Community and Economic Development
- Comparative and International Education
- Comparative Literature
- Computer Science
- Computer Science and Engineering
- Corporate Innovation and Entrepreneurship
- Counselor Education
- Criminal Justice

- Criminal Justice Policy and Administration
- Criminology
- Curriculum and Instruction
- Cybersecurity Analytics and Operations
- Data Analytics
- Demography
- Ecology
- Economics
- Ecosystem Management and Administration
- Education
- Education Policy and Leadership
- Education, Development and Community Engagement
- Educational Leadership
- Educational Psychology
- Educational Theory and Policy
- Electrical Engineering (Capital)
- Electrical Engineering (Engineering)
- Energy and Mineral Engineering
- Energy, Environmental, and Food Economics
- Engineering
- Engineering at the Nano-scale
- Engineering Design
- Engineering Leadership and Innovation Management
- Engineering Management (Capital)
- Engineering Management (Great Valley)
- Engineering Science and Mechanics
- Engineering Systems
- Engineering, Law, and Policy
- English
- Enterprise Architecture and Business Transformation
- Entomology
- Environmental Engineering
- Epidemiology
- Finance (Great Valley)
- Finance (Smeal)
- Food Science
- Forensic Science
- Forest Resources
- French and Francophone Studies
- Geodesign
- Geographic Information Systems
- Geography
- Geosciences
- German
- Health Administration
- Health Policy and Administration
- Higher Education
- History
- Homeland Security
- Hospitality Management
- Human Development and Family Studies
- Human Resources and Employment Relations
- Industrial Engineering
- Informatics
- Information Science
- Information Systems
- Integrative and Biomedical Physiology
- International Affairs
- International Agriculture and Development
- Kinesiology
- Labor and Global Workers' Rights
- Laboratory Animal Medicine
- Landscape Architecture
- Language Science
- Leadership Development
- Learning, Design, and Technology
- Lifelong Learning and Adult Education
- Marketing Analytics and Insights
- Mass Communications
- Materials Science and Engineering
- Mathematics
- Mechanical Engineering (Capital)
- Mechanical Engineering (Engineering)
- Media Studies
- Meteorology and Atmospheric Science
- Microbiome Sciences
- Molecular, Cellular and Integrative Biosciences
- Music
- Music Education
- Neuroscience (Hershey)
- Neuroscience (Science)
- Nuclear Engineering
- Nursing
- Nutritional Sciences
- Operations Research
- Organization Development and Change
- Pathobiology
- Philosophy
- Physics
- Piano Performance
- Plant Biology
- Plant Pathology
- Political Science
- Project Management
- Psychology
- Psychology of Leadership
- Public Administration
- Public Health
- Public Policy
- Quality and Manufacturing Management
- Real Estate Analysis and Development
- Recreation, Park, and Tourism Management
- Renewable Energy and Sustainability Systems
- Rural Sociology

- Russian and Comparative Literature
- School Psychology
- Social and Behavioral Neuroscience
- Social Data Analytics
- Social Work
- Sociology
- Software Engineering
- Soil Science
- Spanish
- Spatial Data Science
- Special Education
- Statistics
- Strategic Communications
- Strategic Management and Executive Leadership
- Supply Chain Management
- Systems Engineering
- Taxation
- Teaching and Curriculum
- Teaching English as a Second Language
- Theatre
- Transdisciplinary Research on Environment and Society
- Turfgrass Management
- Visual Studies
- Wildlife and Fisheries Science
- Women's, Gender, and Sexuality Studies
- Workforce Education and Development

- Adult Gerontology Primary Care Nurse Practitioner Graduate Credit Certificate Program
- Advanced Principal Graduate Credit Certificate Program
- Agricultural Biosecurity and Food Defense Graduate Credit Certificate Program
- AI Engineering Graduate Credit Certificate Program
- Analytics for Managers Graduate Credit Certificate Program
- Ancient Languages Postbaccalaureate Credit Certificate Program
- Applied Behavior Analysis Graduate Credit Certificate Program
- Applied Demography Graduate Credit Certificate Program
- Applied Statistics Graduate Credit Certificate Program
- Business Analytics Graduate Credit Certificate Program
- Business Architecture Graduate Credit Certificate Program
- Business Management Foundations Graduate Credit Certificate Program
- Business Process Integration Graduate Credit Certificate Program
- Business Sustainability Strategy Graduate Credit Certificate Program
- Business-to-Business Marketing Graduate Credit Certificate Program
- Children's Literature Graduate Credit Certificate Program
- Clinical Research Graduate Credit Certificate Program
- Community and Economic Development Graduate Credit Certificate Program
- Computer Vision Graduate Credit Certificate Program
- Corporate Innovation and Entrepreneurship Graduate Credit Certificate Program
- Counterterrorism Graduate Credit Certificate Program
- Cyber Threat Analytics and Prevention Graduate Credit Certificate Program
- Data Analytics and Engineering Graduate Credit Certificate Program
- Data Analytics Graduate Credit Certificate Program
- Data Engineering for Analytics Graduate Credit Certificate Program
- Dietetic Internship Postbaccalaureate Credit Certificate Program
- Distance Education Postbaccalaureate Credit Certificate Program
- Diversity and Inclusion as Strategy Graduate Credit Certificate Program
- Diversity, Ethics, and Leadership Postbaccalaureate Credit Certificate Program
- e-Learning Design Graduate Credit Certificate Program
- Educating Individuals with Autism Postbaccalaureate Credit Certificate Program
- Educational Technology Integration Postbaccalaureate Credit Certificate Program
- Electrical Engineering Post-Baccalaureate Credit Certificate Program
- Engineering Leadership and Innovation Management Graduate Credit Certificate Program
- English as a Second Language Program Specialist Postbaccalaureate Credit Certificate Program
- Enterprise Architecture Graduate Credit Certificate Program
- Enterprise Information and Security Technology Architecture Graduate Credit Certificate Program
- Entrepreneurship & New Ventures Graduate Credit Certificate Program
- Family Literacy Postbaccalaureate Credit Certificate Program

Graduate Minor Programs

- Computational Materials Graduate Minor
- Computational Science Graduate Minor
- Electrochemical Science and Engineering Graduate Minor
- Gerontology Graduate Minor
- Holocaust and Genocide Studies Graduate Minor
- Information and Communication Technologies for Development Graduate Minor
- Jewish Studies Graduate Minor
- Latin American Studies Graduate Minor
- Latina and Latino Studies Graduate Minor
- Linguistics Graduate Minor
- Literary Theory, Criticism, and Aesthetics Graduate Minor
- Science, Technology, and Society Graduate Minor
- Social Thought Graduate Minor

Graduate Certificate Programs

- Accounting Foundations Graduate Credit Certificate Program
- Accounting Graduate Credit Certificate Program
- Additive Manufacturing and Design Graduate Credit Certificate Program
- Adult Basic Education Post-baccalaureate Credit Certificate Program
- Adult Education in the Health and Medical Professions Graduate Credit Certificate Program
- Adult Gerontology Acute Care Nurse Practitioner Graduate Credit Certificate Program

- Family/Individual Across the Lifespan Nurse Practitioner Graduate Credit Certificate Program
- Financial Accounting Graduate Credit Certificate Program
- Financial Analysis Graduate Credit Certificate Program
- Financial Analytics Graduate Credit Certificate Program
- Financial Engineering Graduate Credit Certificate Program
- Folklore and Ethnography Graduate Credit Certificate Program
- Foundations of Artificial Intelligence Graduate Credit Certificate Program
- Foundations of Data Science Graduate Credit Certificate Program
- Fundamentals of Leadership Graduate Credit Certificate Program
- Geodesign Graduate Credit Certificate Program
- Geographic Information Systems Postbaccalaureate Credit Certificate Program
- Geospatial Intelligence Analytics Graduate Credit Certificate Program
- Geospatial Programming and Web Map Development Graduate Credit Certificate Program
- Global Health Graduate Credit Certificate Program
- Global Justice and Security Graduate Credit Certificate Program
- Global Management Graduate Credit Certificate Program
- Healthcare Supply Chain and Operations Management Graduate Credit Certificate Program
- Heritage and Museum Practice Graduate Credit Certificate Program
- Homeland Security Graduate Credit Certificate Program
- Hospital and Health System Preparedness Graduate Credit Certificate Program
- Hospitality Management Graduate Credit Certificate Program
- Human Resource Management Graduate Credit Certificate Program
- Human Resources and Employment Relations Foundations Graduate Credit Certificate Program
- Information Systems Cybersecurity Graduate Credit Certificate Program
- Institutional Research Graduate Credit Certificate Program
- International Affairs Graduate Credit Certificate Program
- International Development Policy Graduate Credit Certificate Program
- International Human Resources and Employment Relations Graduate Credit Certificate Program
- International Public Policy Graduate Credit Certificate Program
- International Security Studies Graduate Credit Certificate Program
- IT Analytics Graduate Credit Certificate Program
- Labor and Collective Bargaining Postbaccalaureate Credit Certificate Program
- Labor and Employment Law Graduate Credit Certificate Program
- Leading in Diversity, Equity & Inclusion Graduate Credit Certificate Program
- Life-Cycle System Design Graduate Credit Certificate Programs
- Management Accounting Graduate Credit Certificate Program
- Management Consulting Graduate Credit Certificate Program
- Management Essentials Graduate Credit Certificate Program
- Marketing Analytics Graduate Credit Certificate Program
- Natural Language Processing Graduate Credit Certificate Program
- Negotiation and Influence Graduate Credit Certificate Program
- Nonprofit Administration Graduate Credit Certificate Program
- Nurse Administrator Graduate Credit Certificate Program
- Nurse Educator Graduate Credit Certificate Program
- Organization Development and Change: Analytics Graduate Credit Certificate Program
- Organization Development and Change: Consulting Skills Graduate Credit Certificate Program
- Organization Development and Change: Essentials Graduate Credit Certificate Program
- Organization Development and Change: Occupational Safety and Health Graduate Credit Certificate Program
- Organization Development and Change: Operational Excellence Graduate Credit Certificate Program
- Organizational Leadership Graduate Credit Certificate Program
- People Analytics and Artificial Intelligence Graduate Credit Certificate Program
- Policy Analysis and Evaluation Graduate Credit Certificate Program
- Primary Palliative Care Graduate Credit Certificate Program
- Principalship Graduate Credit Certificate Program
- Project Management Graduate Credit Certificate Program
- Project Quality Management Graduate Credit Certificate Program
- Psychology of Ethical Leadership Graduate Credit Certificate Program
- Psychology of Leadership Foundations Graduate Certificate
- Psychology of Team Leadership Graduate Credit Certificate Program
- Public Budgeting and Financial Management Graduate Credit Certificate Program
- Public Health Graduate Credit Certificate Program
- Public Health Preparedness Graduate Credit Certificate Program
- Public Sector Human Resources Management Graduate Credit Certificate Program
- Quality Management Across Product Lifecycle Graduate Credit Certificate Program
- Quantitative Business Essentials Graduate Credit Certificate Program
- Quantitative Decision Making for Engineering Managers Graduate Credit Certificate Program
- Real Estate Law and Valuation Graduate Credit Certificate Program
- Remote Sensing and Earth Observation Graduate Credit Certificate Program
- Sensory and Consumer Science Graduate Credit Certificate Program
- Software Architecture and Design Graduate Credit Certificate Program
- Solar Energy Graduate Credit Certificate Program
- Strategic Human Resources and Workplace Ethics Graduate Credit Certificate
- Strategic Leadership Graduate Credit Certificate Program
- Superintendency Graduate Credit Certificate Program
- Supply Chain and Operations Management Graduate Credit Certificate Program
- Supply Chain Management Graduate Credit Certificate Program
- Supply Chain Risk Management Graduate Credit Certificate Program
- Survey Research Methods Graduate Credit Certificate Program
- Sustainability & Social Impact Graduate Credit Certificate Program
- Sustainability Management and Policy Graduate Credit Certificate Program
- Sustainable Development in Africa Graduate Credit Certificate Program
- System Modeling and Analysis Graduate Credit Certificate Program

- System Quality & Risk Evaluation Graduate Credit Certificate Program
- Systems Data Analytics Graduate Credit Certificate Programs
- Talent Management Graduate Credit Certificate Program
- Taxation Graduate Credit Certificate Program
- Teacher Leadership Graduate Credit Certificate Program
- Technical Management and Leadership Essentials Graduate Credit Certificate Program
- Technical Management Graduate Credit Certificate Program
- Translational Science Graduate Credit Certificate Program
- Trauma-Informed Psychotherapy Graduate Credit Certificate Program

Graduate Majors

Penn State offers more than 190 graduate major degree programs. Below you will find a full catalog of all graduate programs available across all campuses and every academic college at Penn State.

The graduate programs listed here are offered under the auspices of the Graduate School. Professional programs are also offered at Dickinson Law (<https://bulletins.psu.edu/dickinsonlaw/>), Penn State Law, and the College of Medicine (<https://bulletins.psu.edu/medicine/>).

- Accounting (Behrend)
- Accounting (Capital)
- Accounting (Great Valley)
- Accounting (Smeal)
- Accounting Analytics
- Acoustics
- Additive Manufacturing and Design
- Aerospace Engineering
- African American and Diaspora Studies
- African Studies
- Agricultural and Biological Engineering
- Agricultural and Environmental Plant Science
- American Studies
- Anatomy
- Ancient Mediterranean Studies
- Animal Science
- Anthropology
- Applied Behavior Analysis
- Applied Linguistics
- Architectural Engineering
- Architecture
- Art
- Art Education
- Art History
- Artificial Intelligence
- Asian Studies
- Astrobiology
- Astronomy and Astrophysics
- Athletic Training
- Biobehavioral Health
- Biochemistry, Microbiology, and Molecular Biology
- Bioethics
- Biogeochemistry
- Bioinformatics and Genomics
- Biology
- Biomedical Engineering
- Biomedical Sciences
- BioRenewable Systems
- Biostatistics
- Biotechnology
- Business Administration (Behrend)
- Business Administration (Capital)
- Business Administration (Executive)
- Business Administration (Great Valley)
- Business Administration (Intercollege)
- Business Administration (Smeal)
- Business Analytics
- Chemical Engineering
- Chemistry
- Civil Engineering (Capital)
- Civil Engineering (Engineering)
- Classics and Ancient Mediterranean Studies
- Climate Science
- Clinical and Translational Sciences
- Clinical Psychology
- Clinical Research
- Communication Arts and Sciences
- Communication Sciences and Disorders
- Communications
- Community and Economic Development
- Comparative and International Education
- Comparative Literature
- Computer Science
- Computer Science and Engineering
- Corporate Innovation and Entrepreneurship
- Counselor Education
- Criminal Justice
- Criminal Justice Policy and Administration
- Criminology
- Curriculum and Instruction
- Cybersecurity Analytics and Operations
- Data Analytics
- Demography
- Ecology
- Economics
- Ecosystem Management and Administration
- Education
- Education Policy and Leadership
- Education, Development and Community Engagement
- Educational Leadership
- Educational Psychology
- Educational Theory and Policy
- Electrical Engineering (Capital)
- Electrical Engineering (Engineering)
- Energy and Mineral Engineering

- Energy, Environmental, and Food Economics
- Engineering
- Engineering at the Nano-scale
- Engineering Design
- Engineering Leadership and Innovation Management
- Engineering Management (Capital)
- Engineering Management (Great Valley)
- Engineering Science and Mechanics
- Engineering Systems
- Engineering, Law, and Policy
- English
- Enterprise Architecture and Business Transformation
- Entomology
- Environmental Engineering
- Epidemiology
- Finance (Great Valley)
- Finance (Smeal)
- Food Science
- Forensic Science
- Forest Resources
- French and Francophone Studies
- Geodesign
- Geographic Information Systems
- Geography
- Geosciences
- German
- Health Administration
- Health Policy and Administration
- Higher Education
- History
- Homeland Security
- Hospitality Management
- Human Development and Family Studies
- Human Resources and Employment Relations
- Industrial Engineering
- Informatics
- Information Science
- Information Systems
- Integrative and Biomedical Physiology
- International Affairs
- International Agriculture and Development
- Kinesiology
- Labor and Global Workers' Rights
- Laboratory Animal Medicine
- Landscape Architecture
- Language Science
- Leadership Development
- Learning, Design, and Technology
- Lifelong Learning and Adult Education
- Marketing Analytics and Insights
- Mass Communications
- Materials Science and Engineering
- Mathematics
- Mechanical Engineering (Capital)
- Mechanical Engineering (Engineering)
- Media Studies
- Meteorology and Atmospheric Science
- Microbiome Sciences
- Molecular, Cellular and Integrative Biosciences
- Music
- Music Education
- Neuroscience (Hershey)
- Neuroscience (Science)
- Nuclear Engineering
- Nursing
- Nutritional Sciences
- Operations Research
- Organization Development and Change
- Pathobiology
- Philosophy
- Physics
- Piano Performance
- Plant Biology
- Plant Pathology
- Political Science
- Project Management
- Psychology
- Psychology of Leadership
- Public Administration
- Public Health
- Public Policy
- Quality and Manufacturing Management
- Real Estate Analysis and Development
- Recreation, Park, and Tourism Management
- Renewable Energy and Sustainability Systems
- Rural Sociology
- Russian and Comparative Literature
- School Psychology
- Social and Behavioral Neuroscience
- Social Data Analytics
- Social Work
- Sociology
- Software Engineering
- Soil Science
- Spanish
- Spatial Data Science
- Special Education
- Statistics
- Strategic Communications
- Strategic Management and Executive Leadership
- Supply Chain Management
- Systems Engineering
- Taxation
- Teaching and Curriculum

- Teaching English as a Second Language
- Theatre
- Transdisciplinary Research on Environment and Society
- Turfgrass Management
- Visual Studies
- Wildlife and Fisheries Science
- Women's, Gender, and Sexuality Studies
- Workforce Education and Development

Accounting (Behrend)

Graduate Program Head	Greg Filbeck
Program Code	ACNTG
Campus(es)	Erie (M.P.Acc.)
Degrees Conferred	Master of Professional Accounting (M.P.Acc.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=ACNTG)

The Master of Professional Accounting (M.P.Acc.) degree program in Accounting requires 30 credit hours beyond the bachelor's degree and will take one year to complete. This program will equip the students for the increasing legal and financial complexities faced by the accounting profession. This degree will also satisfy the requirements for taking the Certified Public Accountant (CPA) examination and becoming a CPA through the Pennsylvania State Board of Accountancy as well as most of the State Boards of the neighboring states.

The program is delivered in a blended format of 25 percent classroom instruction on campus or at the Regional Learning Alliance in Cranberry Township and 75 percent online learning.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Admission cannot be granted to individuals who require a student visa due to the majority of instruction taking place online.

Applicants should have an undergraduate degree in business and the course work should be substantially similar to the Penn State Erie undergraduate degree in business. If the degree is in business but not in accounting then applicants should have the following courses or their equivalents completed with B or better in every course:

Code	Title	Credits
ACCTG 211	Financial and Managerial Accounting for Decision Making	4
ACCTG 310	Federal Taxation I	3

ACCTG 340	Cost Accounting	3
ACCTG 371	Intermediate Accounting I	4
ACCTG 403	Auditing	3
ACCTG 472	Intermediate Financial Accounting II	3

Applicants should have a minimum 2.8 GPA (on a 4.0 scale) in the junior and senior years, and a minimum 3.0 GPA (on a 4.0 scale) in the accounting courses.

Applicants must submit the following documents:

1. Online Graduate School application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) including nonrefundable application fee
2. Statement of intent
3. Official transcripts from all post-secondary institutions attended (<http://gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>)
4. TOEFL or IELTS scores, if applicable

Degree Requirements

Master of Professional Accounting (M.P.Acc.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

A minimum of 30 credits is required for the degree that must be acquired in 400-, 500-, or 800-level courses. At least 21 of the 30 credits must be 500 and 800 level courses, at least 9 credits (of the 21 credits) must be at the 500 level, and the remaining 9 credits must be at 400, 500, or 800 level.

The following courses need to be completed for a total of 30 credits.

Code	Title	Credits
Required Courses		
BLAW 444	Advanced UCC and Commercial Transactions	3
ACCTG 806	Taxes and Business Planning	3
or ACCT 510	Business Tax Planning Theory and Practice	
ACCTG 873	Advanced Topics in Financial Reporting	3
or ACCT 573	Financial Reporting II	
ACCTG 881	Financial Statement Analysis	3
or ACCT 561	Financial Statement Analysis II	
ACCT 504	Auditing Theory and Practice	3
ACCT 545	Strategic Cost Management	3
BADM 526	Leadership and Ethics	3
or ACCT 550	Professional Responsibilities and Ethics in Accounting	
FIN 451	Intermediate Financial Management	3
Electives		
3 credits of elective (Approved 400-, 500-, or 800-level course) or 3 credits of Internship (ACCTG 595)		3
Culminating Experience		
ACCTG 803	Forensic Accounting and Litigation Support (Capstone Course)	3
Total Credits		30

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

A limited number of scholarships and graduate assistantships are available. Many students work full time and take classes part time. In many cases, employers have a tuition-reimbursement plan paying for partial or full tuition. View student aid options (<https://behrend.psu.edu/admissions-financial-aid/financial-aid/incoming-students/graduate/>) available.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Accounting (ACCT) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/acct/>)

Accounting (ACCTG) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/acctg/>)

Business Administration (BADM) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/badm/>)

Business Law (BLAW) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/blaw/>)

Finance (FIN) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/fin/>)

Learning Outcomes

- COMMUNICATE:** Graduates will develop effective presentation and written communication skills.
 - Graduates are able to prepare and deliver a professional presentation about a business problem.
 - Graduates are able to demonstrate effective written communication skills.
- THINK, APPLY/CREATE:** Graduates will be able to think critically, solve problems, and make decisions.
 - Graduates are able to objectively identify and prioritize accounting problems.
 - Graduates are able to develop alternative solutions to accounting problems.
 - Graduates demonstrate sufficient skills to read, reason logically, and draw relevant conclusions.
- PROFESSIONAL PRACTICE:** Graduates will be able to recognize ethical issues in business and know how to deal with them.
 - Graduates will recognize ethical issues in business situations.
 - Graduates will apply ethical frameworks to business problems.
 - Graduates will describe the ethical consequences of decision alternatives.
- KNOW:** Graduates will have technical competency in accounting.
 - Graduates will demonstrate technical competency in accounting skills in taxation.
 - Graduates will demonstrate technical competency in accounting skills in managerial accounting.
 - Graduates will demonstrate technical competency in accounting skills in auditing.
 - Graduates will demonstrate technical competency in financial statement analysis.
 - Graduates will demonstrate technical competency in accounting theory and research.

Professional Licensure/Certification

Many U.S. states and territories require professional licensure/certification to be employed. If you plan to pursue employment in a licensed profession after completing this program, please visit the Professional Licensure/Certification Disclosures by State (<https://www.psu.edu/state-licensure-disclosures/>) interactive map.

Contact

Campus	Erie
Graduate Program Head	Greg Filbeck
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Ashutosh V Deshmukh
Program Contact	Ashutosh V Deshmukh 5101 Jordan Road Erie PA 16563 avd1@psu.edu (814) 898-6438
Program Website	View (https://behrend.psu.edu/school-of-business/academic-programs/master-of-professional-accounting/)

Accounting (Capital)

Graduate Program Head	John Haddad
Program Code	IACCT
Campus(es)	World Campus (M.P.Acc.)
Degrees Conferred	Master of Professional Accounting (M.P.Acc.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=IACCT)

Accreditation and Certification

The Master of Professional Accounting program requirements are designed to allow a student who has completed an undergraduate degree in Accounting (or equivalent) to satisfy the current educational requirements for CPA licensure in Pennsylvania and most if not all other states¹.

¹ The degree to which Texas is willing to accept on-line courses is uncertain, and they require applicants to select an ethics course from a pre-approved list. FL, KS, NJ, and WV all require 6 credit hours of Business Law, so students who desire licensure in those states must have a 3 credit undergraduate course in Business Law to complement the graduate course contemplated in this program. Students with an undergraduate degree in business are assumed to meet this requirement.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students who apply for admission should have course work substantially equivalent to an undergraduate degree in Business (or a business discipline) from Penn State University. If the undergraduate major is not Accounting, an applicant should have completed the following minimum core of accounting coursework (or its equivalent):

Code	Title	Credits
ACCTG 211	Financial and Managerial Accounting for Decision Making	4
ACCTG 310	Federal Taxation I	3
ACCTG 340	Cost Accounting	3
ACCTG 403	Auditing	3
ACCTG 471	Intermediate Financial Accounting I	3
ACCTG 472	Intermediate Financial Accounting II	3
FIN 301	Corporation Finance	3

Students should have a grade point average of at least 3.0 (on a 4.0 scale) in their final 60 credits of undergraduate coursework, both overall as well as in Accounting courses. Students must submit scores from the Graduate Management Admissions Test (GMAT) or Graduate Record Examination (GRE).

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students

(<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of Professional Accounting (M.P.Acc.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students must complete a minimum of 30 credit hours of instruction; all credits must be earned in 400 level, 500 level, or 800 level courses. A minimum of 21 credits at the 500- or 800-level is required, of which at least 9 credits must be earned in 500-level courses. Students must complete the following courses:

Code	Title	Credits
Required Courses		
ACCT 572	Financial Reporting I	3
PADM 523	Governmental and Nonprofit Accounting	3
ACCT 550	Professional Responsibilities and Ethics in Accounting	3
ACCT 532	Accounting Information and Decision Systems	3
ACCTG 881	Financial Statement Analysis	3
or ACCT 561	Financial Statement Analysis II	
ACCTG 806	Taxes and Business Planning	3
or ACCT 510	Business Tax Planning Theory and Practice	
ACCT 504	Auditing Theory and Practice	3
BLAW 444	Advanced UCC and Commercial Transactions	3
ACCT 545	Strategic Cost Management	3
Culminating Experience		
ACCTG 803	Forensic Accounting and Litigation Support (Capstone Course)	3
Total Credits		30

ACCTG 803 is the capstone course for the program, integrating materials learned in the other program courses.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)

- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Accounting (ACCT) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/acct/>)

Professional Licensure/Certification

Many U.S. states and territories require professional licensure/certification to be employed. If you plan to pursue employment in a licensed profession after completing this program, please visit the Professional Licensure/Certification Disclosures by State (<https://www.psu.edu/state-licensure-disclosures/>) interactive map.

Contact

Campus	World Campus
Graduate Program Head	John Haddad
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Renee Flasher
Program Contact	Sherri Dorazio Harkins Graduate Admissions 777 West Harrisburg Pike Middletown PA 17057 sxh749@psu.edu (717) 948-6008
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-masters-in-professional-accounting-degree/overview/)

Accounting (Great Valley)

Graduate Program Head	Zugang Liu
Program Code	ACCNT
Campus(es)	Great Valley (M.P.Acc.)
Degrees Conferred	Master of Professional Accounting (M.P.Acc.) Integrated B.S. in Accounting and M.P.Acc. in Accounting
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=ACCNT)

The Master of Professional Accounting program at Penn State Great Valley is taught by renowned faculty. Evening and hybrid courses delve into competencies covered in the CPA exam, including regulation, financial accounting and reporting, audition and attestation, and business environment and concepts. Students can expect to complete the 30-credit program in less than one year with a fall admission attending full-time, or two years if going part-time.

The program culminates in a capstone course that builds on previous coursework to develop analytical and presentation skills. Utilizing case studies, students will study investigative, consulting, and forensic accounting as they examine a current issue in regulation. Through this comprehensive project, they acquire a big-picture understanding of trends and issues, along with the critical-thinking skills to evaluate and debate them. The program is fully accredited by AACSB International.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students who apply for admission should have completed course work substantially equivalent to an undergraduate degree in accounting. Applicants to the Penn State Great Valley M.P.Acc. program should also have a grade-point average of at least 3.0 (on a 4.0 scale) in their final 60 credits of undergraduate course work, both overall as well as in accounting courses.

If the undergraduate major is not Accounting, an applicant must have completed the following minimum core of accounting course work (or its equivalent) with a final grade of B- or better.

Code	Title	Credits
ACCTG 211	Financial and Managerial Accounting for Decision Making	4
ACCTG 310	Federal Taxation I	3
ACCTG 340	Cost Accounting	3
ACCTG 403	Auditing	3
ACCTG 471	Intermediate Financial Accounting I	3
ACCTG 472	Intermediate Financial Accounting II	3

GMAT/GRE scores are not required nor will they be accepted.

Degree Requirements

Master of Professional Accounting (M.P.Acc.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students must complete a minimum of 30 credits at the 400, 500, or 800 level, with at least 18 at the 500 or 800 level, and a minimum of 9 credits at the 500 level. This includes 21 credits in the required core courses:

Code	Title	Credits
Required Courses		
ACCTG 512	Financial Accounting Theory and Reporting Problems	3
BLAW 444	Advanced UCC and Commercial Transactions	3
ACCTG 806	Taxes and Business Planning	3
ACCTG 873	Advanced Topics in Financial Reporting	3
ACCT 532	Accounting Information and Decision Systems	3
ACCT 550	Professional Responsibilities and Ethics in Accounting	3
Electives		
The remaining 9 credits of electives may be chosen from a list of approved electives maintained by the program office. Note that one of the electives must be a 500-level graduate course.		9
Culminating Experience		
ACCTG 831	Advanced Auditing (Capstone Course)	3
Total Credits		30

ACCTG 831 serves as the capstone course for this degree. This capstone course taken at the end of the program uses all the knowledge gained from prior coursework and applies them through presentation and analysis of case studies. Students will study investigative accounting, consulting, and litigation support activities undertaken in forensic accounting engagements through the use of case studies. This capstone course includes a final capstone project which emphasizes case analysis to develop critical thinking and analytical skills in the use of accounting reports for broad-based business analysis. In this capstone project, students examine a current issue in accounting and regulation. Through this comprehensive capstone project, students acquire a big-picture understanding of accounting trends and regulatory issues, along with the critical-thinking skills to evaluate and debate them.

Integrated Undergrad-Grad Programs

Integrated B.S. in Accounting and M.P.Acc. in Accounting

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Accounting with the M.P.Acc. in Accounting offered at the following campuses:

Undergraduate Degree

- Abington
- Altoona
- Berks
- Harrisburg
- World Campus

Graduate Degree

- Great Valley

The graduate portion of this IUG is currently offered as face-to-face residential instruction. While the undergraduate curriculum for this IUG may be completed at multiple campuses, the ease and feasibility of completing the integrated program may be heavily dependent upon the location of the graduate instruction. Please discuss the feasibility of completing the IUG with a representative for the graduate program before beginning the application process.

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The IUG program offers exceptional students the ability to receive a B.S. in Accounting and a Master of Professional Accounting (MPAcc) within a five year period. Students are typically admitted into the integrated program at the end of their second year of their undergraduate studies, and then complete the IUG program over the next three years. Students must have completed no less than 60 credits to apply, and transfer students must have completed at least 15 credits at Penn State to enroll in the IUG.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<http://gradschool.psu.edu/graduate-education-policies/>).

Students must apply to the program via the Graduate School application for admission, and must meet all the admission requirements of the Graduate School and the Accounting graduate program for the Master of Professional Accounting degree, as listed on the Admission Requirements tab. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.

Applicants are required to submit GMAT or GRE scores. The GMAT/GRE requirement is waived for IUG applicants with an undergraduate GPA of 3.2 or higher.

In consultation with an adviser, students must prepare a plan of study appropriate to this integrated program, and must present their plan of study to the head of the graduate program overseeing the integrated program prior to being admitted to the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.S. in Accounting at Abington and Berks campuses are listed in the Undergraduate Bulletin.

Degree requirements for the M.P.Acc. degree are listed on the Degree Requirements tab.

The following is the list of courses which will double count for both the B.S. in Accounting and the Master of Professional Accounting. Up to 12 credits may be double counted towards the degree requirements of both undergraduate and graduate degrees; a minimum of 50% of the double counted credits must be at the 500 or 800 level.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
BLAW 444	Advanced UCC and Commercial Transactions	3
ACCT 550	Professional Responsibilities and Ethics in Accounting	3
ACCT 532	Accounting Information and Decision Systems	3
ACCTG 512	Financial Accounting Theory and Reporting Problems	3

Students must sequence their courses so that all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. #Students must complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.P.Acc. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Refer to the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students in this program are not eligible for graduate assistantships.

Financial aid for students in on-campus programs is in the form of student loans and a limited number of small scholarships, as described

on the Penn State Great Valley website (<https://greatvalley.psu.edu/tuition-and-financial-aid/>).

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Accounting (ACCT) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/acct/>)

Accounting (ACCTG) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/acctg/>)

Business Law (BLAW) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/blaw/>)

Professional Licensure/Certification

Many U.S. states and territories require professional licensure/certification to be employed. If you plan to pursue employment in a licensed profession after completing this program, please visit the Professional Licensure/Certification Disclosures by State (<https://www.psu.edu/state-licensure-disclosures/>) interactive map.

Contact

Campus	Great Valley
Graduate Program Head	Zugang Liu
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Bo Ouyang
Program Contact	Teri Shaw 30 East Swedesford Road Malvern PA 19355 tks5856@psu.edu (610) 648-3250
Program Website	View (http://greatvalley.psu.edu/academics/masters-degrees/accounting/)

Accounting (Smeal)

Graduate Program Head	Henock Louis
Program Code	ACCTG
Campus(es)	University Park (M.Acc.)
Degrees Conferred	Master of Accounting in Accounting (M.Acc.) Integrated B.S. in Accounting and M.Acc. in Accounting
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=ACCTG)

The Master of Accounting allows students to complete the educational requirements to become a certified public accountant in Pennsylvania, as well as most other states. Certified Public Accountants (CPAs) conduct independent audits and provide accounting, tax, and management advisory services. The program emphasizes quantitative methods,

analytics, and management science as they relate to the modern accounting profession. The program prepares students to enter into careers in public accounting, corporate accounting, management accounting, governmental accounting, financial analysis, and law enforcement.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Applicants must:

- Submit a completed online Graduate School Application for Admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>), including short admissions essay, resume, and three professional references with complete contact information.
 - Résumé reflecting relevant professional experience including internships and co-op experiences.
- Submit official transcripts from all post-secondary institutions attended (<http://gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>).

GMAT and/or GRE scores will not be required for admission. Accordingly, these scores will not be accepted.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of Accounting in Accounting (M.Acc.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students must complete a minimum of 33 credits. The 33 credits must be earned in 400-, 500-, or 800-level courses. At least 18 credits must be earned in 500- and 800-level courses.

Code	Title	Credits
Required Courses		
ACCTG 432	Accounting Information Systems	3
ACCTG 495	Internship	3
BA 817	Communication Skills for Management	3
ACCTG 804	Data Analytics in the Accounting Profession	3
ACCTG 805	Applied Accounting and Financial Analytics	3
ACCTG 881	Financial Statement Analysis	3
Electives		
12 credits of elective courses selected in consultation with their adviser. A list of approved elective courses is maintained by the graduate program office.		12
Culminating Experience		

ACCTG 573	Topics in Financial Reporting (Capstone Course)	3
Total Credits		33

Integrated Undergrad-Grad Programs

Integrated B.S. in Accounting and M.Acc. in Accounting

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Accounting with the M.Acc. in Accounting offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- University Park

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The Department of Accounting offers an integrated program allowing students to receive a B.S. in Accounting and Master of Accounting (M.Acc.) degrees within a five-year period. Students typically are admitted into the integrated program in the spring of the second year of the undergraduate program and the program is completed in the subsequent three years.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students must apply to the program via the Graduate School application for admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet all the admission requirements of the Graduate School and the Accounting graduate program for the Master of Accounting degree, listed above. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.

In addition, the Department may request an interview with an applicant, or require a GMAT exam or other exam. Admissions decisions will be based upon the student's application, undergraduate record, SAT scores and, if applicable, interviews and examination results.

In consultation with an adviser, students must prepare a plan of study appropriate to this integrated program, and must present their plan of study to the head of the graduate program or the appropriate committee overseeing the integrated program prior to being admitted to the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.

Degree Requirements

Students must fulfill all degree requirements for each degree in order to be awarded that degree, subject to the alterations and double-counting of credits as outlined below. Degree requirements for the Bachelor of Science in Accounting are listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>). Degree requirements for the Master of Accounting degree are listed on the Degree Requirements tab. If students accepted into the IUG program are unable to complete the M.Acc. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Students must complete the requirements for a B.S. in Accounting with the following alterations. Some of prescribed courses for the B.S. must be taken in sections that are available only to students enrolled in the program. These prescribed courses, which all count toward the undergraduate degree in accounting, are:

Code	Title	Credits
ACCTG 403W	Auditing	3
ACCTG 404	Managerial Accounting: Economic Perspective	3
ACCTG 405	Principles of Taxation I	3
ACCTG 471	Intermediate Financial Accounting I	3
ACCTG 472	Intermediate Financial Accounting II	3

The student need not satisfy the requirement that 6 credits be completed from the following list of courses:

Code	Title	Credits
ACCTG 406	Principles of Taxation II	3
ACCTG 432	Accounting Information Systems	3
ACCTG 473	Advanced Financial Accounting	3
ACCTG 481	Financial Statement Analysis: Accounting Based Evaluation and Decision Making	3

The following courses cannot be used to satisfy the degree requirements of the B.S. or the M.Acc. for students in the integrated B.S./M.Acc. program:

Code	Title	Credits
ACCTG 410	Federal Taxation II	3
ACCTG 411	Accounting Practicum: VITA	3
ACCTG 417	Corporate and Managerial Communication	2-3
ACCTG 422	Accounting Systems	3
ACCTG 450	Advanced Accounting	3
ACCTG 473	Advanced Financial Accounting	3
ACCTG 481	Financial Statement Analysis: Accounting Based Evaluation and Decision Making	3

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
ACCTG 804	Data Analytics in the Accounting Profession	3
ACCTG 881	Financial Statement Analysis	3

Any M.Acc. course approved by M.Acc. Director	3
Any M.Acc. course approved by M.Acc. Director	3

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Refer to the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students in this program are not eligible for graduate assistantships.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Accounting (ACCTG) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/acctg/>)

Business Administration (BA) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/ba/>)

Business Law (BLAW) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/blaw/>)

Finance (FIN) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/fin/>)

Learning Outcomes

- COMMUNICATE:** Argue one's point persuasively in written form and oral presentation.
- KNOW:** Assess and explain the global forces that influence business decisions and accounting practices.
- PROFESSIONAL PRACTICE:** Assemble and support a team as both a principled leader and a valuable member while adhering to professional accounting standards.

4. **APPLY/CREATE:** Analyze a complicated business problem using the best tools, theories, and evidence, complemented by the ability to recommend solutions and implement plans.
5. **THINK:** Compare and contrast perspectives in analyzing and recommending solutions to business problems.
6. **APPLY/CREATE:** Apply quantitative skills through the use of complex searchable databases and analytical search tools in the financial accounting and auditing environments.

Professional Licensure/Certification

Many U.S. states and territories require professional licensure/certification to be employed. If you plan to pursue employment in a licensed profession after completing this program, please visit the Professional Licensure/Certification Disclosures by State (<https://www.psu.edu/state-licensure-disclosures/>) interactive map.

Contact

Campus	University Park
Graduate Program Head	Henock Louis
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Schalyn N Sohn
Program Contact	Tammy Whitehill 354 Business Building University Park PA 16802 tas1@psu.edu (814) 865-0041
Program Website	View (http://www.smeal.psu.edu/macc/)

Accounting Analytics

Graduate Program Head	Henock Louis
Program Code	MAA
Campus(es)	University Park (M.Acc.)
Degrees Conferred	Master of Accounting (M.Acc.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=facprog=MAA)

The Master of Accounting in Accounting Analytics program qualifies students to assume responsibilities beyond those that are traditionally assumed by graduates from Master of Accounting (MAcc) programs. The Accounting Analytics (MAA) curriculum focuses heavily on the use of complex searchable databases and analytical search tools in a financial accounting and auditing environment, with a core emphasis on modelling, mathematical applications, and predictive science. As students learn the use of quantitative tools, they will be trained to apply the acquired knowledge to identify exceptions to the norm within large data sets and to use the best approaches to quantify potential misstatements within financial accounting information.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Applicants must:

- Submit a completed online Graduate School Application for Admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>), including short admissions essay, resume, and three professional references with complete contact information.
 - Résumé reflecting relevant professional experience including internships and co-op experiences.
- Submit official transcripts from all post-secondary institutions attended (<http://gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>).

GMAT and/or GRE scores will not be required for admission. Accordingly, these scores will not be accepted.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The total number of credits required for the M.Acc. degree is 30 credits at the 400, 500, or 800 level, with at least 18 credits at the 500 or 800 level and at least 6 credits at the 500 level.

There are 30 specified credits comprised of the following courses:

Code	Title	Credits
Core Courses		
The core Accounting Analytics courses are designed to provide students with a broad set of skills and tools related to the field of Data Science, within an Accounting-focused knowledge domain.		
ACCTG 432	Accounting Information Systems	3
ACCTG 522	Corporate Taxation and Financial Reporting	3
ACCTG 573	Topics in Financial Reporting	3
ACCTG 804	Data Analytics in the Accounting Profession	3
ACCTG 881	Financial Statement Analysis	3
Electives		
Students will also complete 12 credits of elective courses. A list of elective courses approved to count towards the degree requirements will be maintained by the program office.		12
Culminating Experience		
The culminating experience for the degree is a capstone course that provides an opportunity for students to apply and integrate the knowledge and skills that were gained throughout the program.		
ACCTG 805	Applied Accounting and Financial Analytics	3
Total Credits		30

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/>).

graduate-education-policies/), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Refer to the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students in this program are not eligible for graduate assistantships.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Achieve a Data-Driven Mindset – the MAA program will help students develop a datadriven mindset, preparing them to interact with data scientists from an accountant's perspective. The program will provide exposure to topics on unstructured data, data extraction, data modeling, visualizations and relational databases.
2. Develop Business Intelligence – the MAA program will enable students to develop the skills necessary to apply modern analytical methods yielding descriptive, diagnostic, predictive, and prescriptive accounting information used for business intelligence.
3. Interact with Current Technology – the MAA program will help provide experience with audit, tax, and financial analytical cases and technologies such as Excel, SAS, and Python and visualization software such as Tableau and Microsoft Power BI.
4. Explore Contemporary Topics – the MAA program will expose student to contemporary topics such as fintech, cryptocurrencies, web scraping, and the use of blockchain.

Contact

Campus	University Park
Graduate Program Head	Henock Louis
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Scott Collins
Program Contact	Tammy Whitehill tas1@psu.edu (814) 865-0041
Program Website	View (https://maa.smeal.psu.edu/)

Acoustics

Graduate Program Head	Andrew Barnard
Program Code	ACS
Campus(es)	University Park (Ph.D., M.S., M.Eng) World Campus (M.Eng.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Master of Engineering (M.Eng.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=ACS)

The aim of this program is to enable the student interested in acoustics to obtain an integrated program covering acoustical science and engineering applications of acoustics.

Student curricula are individually tailored and integrated through a selection of core and elective courses in areas such as:

- fundamentals of sound and vibration
- sound radiation and propagation
- signal analysis
- electroacoustic transducers
- physical acoustics
- nonlinear acoustics
- computational acoustics
- architectural acoustics
- medical ultrasonics
- structural acoustics and vibration
- aeroacoustics and flow noise
- audio engineering and spatial sound
- musical acoustics
- psychoacoustics
- speech and communication
- experimental techniques
- underwater acoustics

The courses are offered by the graduate program in Acoustics and by other participating University departments, including:

- Aerospace Engineering
- Architectural Engineering
- Bioengineering
- Communication Sciences and Disorders
- Electrical Engineering
- Engineering Science and Mechanics
- Geosciences
- Mechanical Engineering
- Meteorology
- Physics

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to

Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Entering students should hold a bachelor's degree in physics, engineering, mathematics, or a closely related field that would provide substantial preparation in mathematics (a minimum of two semesters of calculus-based physics and mathematics to include complex variables and differential equations). In addition, an undergraduate knowledge of statics and dynamics, linear algebra, and electronic circuit analysis, and the ability to use mathematical analysis software is expected. Students with a 3.00 junior/senior average (on a 4.00 scale), appropriate course backgrounds, and a B+ or better average in mathematics, physical science, and engineering courses will be considered for admission. The best-qualified applicants will be accepted up to the number of spaces that are available for new students. An individual with nontechnical background may also apply, but acceptance into the program will depend significantly on the applicant's undergraduate background and motives to pursue advanced study in acoustics. Exceptions to the minimum 3.00 grade-point average may be made for students with special backgrounds and abilities.

Graduate Record Exam (GRE) scores will be considered if provided, but they are neither required nor expected.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

In addition, the Acoustics Program requires a minimum speaking score on the TOEFL internet based test (iBT) of 25 or a minimum acceptable composite score from the International English Language Testing System of 6.5.

Admission to the Ph.D. program is a two-step process. First, the candidate must apply to the Acoustics Program via the Graduate School application for admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) as a Ph.D. student, and the application is reviewed by the Admissions Committee. Admission will permit the student to begin working toward a doctoral degree. However, the student is not a doctoral candidate until he or she has passed the comprehensive examination and been admitted to candidacy.

Degree Requirements

Master of Engineering (M.Eng.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The Master of Engineering (M.Eng.) degree is a non-thesis professional master's degree, and it may be earned by resident students at University Park or through distance education. The Master of Engineering degree is based on graduate course work and a written paper or a developmental study must be submitted to the Acoustics program. Normally, such a paper represents a study of a particular topic that is more limited than that necessary for a thesis. The paper is free of any formal requirements of the Graduate School, but it is expected that the student will use the Thesis Guide as an example of the appropriate format. The total number of credits required for the M. Eng. degree is 30 of which 18 credits must be from 500-level approved core courses in Acoustics. The 12 non-core

course credits may be selected from the "Required and Approved" list of courses issued by the Acoustics Program Office. Students may take more than one credit of Colloquium (ACS 590) and more than six credits of Individual Study (ACS 596), but such additional credits cannot be applied to the total number of course credits required. Master of Engineering students may not apply research credits (ACS 600) to the total number of course credits required. The expected duration to complete the M.Eng. degree is 2 years for resident students.

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The Master of Science (M.S.) degree program is based on a combination of graduate course work and research training that is documented and culminates (a) in a Master of Science thesis or (b) in a scholarly paper. The M.S. degree in Acoustics is only available for resident students at University Park. For track (a) both the course selection and research are directed by an adviser. When the student is working on the thesis research, at least two other faculty members, upon the adviser's suggestion, will be recommended to the Program Chair who will approve the thesis committee. The total number of credits required for the M.S. degree is 30, and at least 20 of those credits must be taken at University Park. 24 course credits are required, of which 18 must be from approved 500-level acoustics core courses. 6 Thesis Research credits (ACS 600) are required for students writing a Master of Science Thesis.

The scholarly paper track (b) is only available for students participating in the one-year M.S. program that requires 12-month continuous registration. As part of the one-year M.S. program students must take one credit of Research Topics (ACS 594) in both the fall and spring semesters, and take a special summer course, Contemporary Research Topics in Acoustics (ACS 580). The scholarly paper will be developed in the ACS 594 classes and will normally be completed as part of ACS 580. This paper will typically be a study of a particular topic that is more limited than that necessary for a thesis. The paper is free of any formal requirements of the Graduate School, but it is expected that the student will use the formatting as described in the Thesis Guide. Students in the one-year M.S. program will not take any Thesis Research credits (ACS 600). The total number of credits required for the M.S. degree is 30, and at least 20 of those credits must be taken at University Park. 24 course credits are required, of which 18 must be from approved 500-level acoustics core courses.

The 6 non-core course credits for either track may be selected from the "Required and Approved" list of courses issued by the Acoustics Program Office. Students may take more than one credit of Colloquium (ACS 590) and more than six credits of Individual Studies (ACS 596) for the paper track or Thesis Research (ACS 600) for the thesis track, but such additional credits cannot be applied to the total number of course credits required for the M.S. degree. The expected duration to complete the M.S. degree with thesis is 2 to 2.5 years and approximately 1 year for students in the one-year resident M.S. program.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The Doctor of Philosophy (Ph.D.) degree is conferred in recognition of high attainment and productive scholarship. A candidate for the Ph.D. degree must pass the English proficiency and qualifying examinations,

prepare and defend a dissertation proposal as part of the comprehensive examination, pass the final oral examination (dissertation defense), and the dissertation must be approved by the Ph.D. committee. Ph.D. students are required to take 21 credits of 500-level Acoustics core courses, but the Ph.D. committee may require the doctoral candidate to take specific additional courses. In addition, a Ph.D. candidate must satisfy the Graduate Council residency requirement by registering for two consecutive semesters, fall and spring, as a full-time student. Post-comprehensive exam, continuous registration is required until the thesis has been approved. Penn State's Graduate School allows eight years from successful completion of the qualifying exam for completion of a doctoral degree. The expected duration to complete the Ph.D. degree is 3 years after the completion of a master's degree or 5 years without a master's degree.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Acoustics (ACS) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/acs/>)

Learning Outcomes

Master of Engineering (M.Eng.)

1. **KNOW:** Graduates will demonstrate understanding of fundamental core principles and methods in Acoustics.
2. **APPLY/CREATE:** Graduates will apply their knowledge of Acoustics to analyze and solve engineering problems.
3. **THINK:** Graduates will synthesize concepts from multiple courses to solve open-ended engineering problems.
4. **COMMUNICATE:** Graduates effectively communicate through written and oral methods.
5. **PROFESSIONAL PRACTICE:** Graduates will demonstrate high standards of ethics and apply best practices in their professional activities.

Master of Science (M.S.)

1. **KNOW:** Graduates will demonstrate understanding of fundamental core principles and methods in Acoustics.
2. **APPLY/CREATE:** Graduates will apply their knowledge of Acoustics to formulate and solve complex engineering problems.
3. **THINK:** Graduates will synthesize knowledge of fundamental and applied acoustics concepts through a research experience.
4. **COMMUNICATE:** Graduates will effectively communicate their research through written and oral methods.
5. **PROFESSIONAL PRACTICE:** Graduates will demonstrate high standards of ethics related to education, research, and apply best practices in their research.

Doctor of Philosophy (Ph.D.)

1. **KNOW:** Graduates will demonstrate a thorough understanding of fundamental and advanced principles and methods of Acoustics.
2. **APPLY/CREATE:** Graduates will apply knowledge of advanced core principles and methods in formulating and executing novel research.
3. **THINK:** Graduates will conduct an analytical and critical review of existing literature related to new research areas.
4. **COMMUNICATE:** Graduates will create technical written and oral reports that meet professional presentation and publication standards in Acoustics.
5. **PROFESSIONAL PRACTICE:** Graduates will demonstrate high standards of ethics and application of best practices in their research and professional activities.

Contact

Campus	University Park
Graduate Program Head	Andrew Barnard
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Andrew Barnard
Program Contact	Melissa Kiehl Wandrisco 201 Applied Science Building University Park PA 16802 myw5290@psu.edu (814) 865-6364
Program Website	View (http://www.acs.psu.edu/)

Campus	World Campus
Graduate Program Head	Andrew Barnard
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Andrew Barnard
Program Contact	Christine Ruth Popovich 201 Applied Science Building University Park PA 16802 cxp23@psu.edu (814) 863-6078
Program Website	View (http://www.acs.psu.edu/)

Additive Manufacturing and Design

Graduate Program Head	Allison Beese
Program Code	AMD
Campus(es)	University Park (M.S.) World Campus (M.Eng.)
Degrees Conferred	Master of Science (M.S.) Master of Engineering (M.Eng.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=AMD)

The overall goal of the Master of Science in Additive Manufacturing and Design and Master of Engineering in Additive Manufacturing and Design is to educate students and working engineers to become technically outstanding experts in additive manufacturing. Specifically, the objectives include:

1. Apply foundational knowledge, critical thinking, problem solving, and creativity in the uses of additive manufacturing and associated design tools and methods.
 2. Grow as leaders in manufacturing while maintaining the highest ethical standards in applying additive manufacturing to industry-relevant problems and design challenges.
 3. Strive for the advancement of the state-of-art in additive manufacturing and design.
 4. Develop innovative solutions through new design paradigms in their respective industries.
- 1.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

To maintain a high quality program, it is important that our students are of a caliber to succeed. As such, the admission requirements for the students enrolling in the M.S. and M.Eng. degree program will be based on: academic records, applicable work experience, their personal

statement of interests in additive manufacturing design, and three letters of recommendation from a previous professor or supervisor who can attest to the applicant's academic potential. Applicants will be expected to have a Bachelor of Science or four-year Associates degree in engineering, manufacturing, materials science, or related field from a U.S. regionally accredited institution or from an officially recognized degree-granting international institution. An undergraduate cumulative grade point average of 3.0 or better on a 4.0 scale in the final two years of undergraduate studies is required. Official GRE scores are not required but will be considered if submitted.

Degree Requirements

Master of Engineering (M.Eng.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

A minimum of 30 credits at the 400, 500, or 800 level is required. At least 18 credits must be at the 500 or 800 level, with a minimum of 6 credits at the 500 level.

Code	Title	Credits
Required Courses		
Complete the following 5 required courses that total 19 credits with a grade point average of 3.00 or higher:		
EDSGN 562	Design for Additive Manufacturing	1
ESC 545	Engineering and Scientific Principles of Additive Manufacturing	1
IE 527	Additive Manufacturing Processes	1
MATSE 567	Additive Manufacturing of Metallic Materials	1
ME 566	Metal Additive Manufacturing Laboratory	1
Complete a minimum of 8 credits of electives in 400 and/or 500 level courses. A listing of approved courses is maintained by the program. ¹		
Complete one credit of colloquium preferably in the first two semesters in the program. The following courses are offered to meet this requirement: ³		
EDSGN 590	Colloquium	1
ESC 514	Engineering Science and Mechanics Seminar	1
IE 590	I E Colloquium	1
MATSE 590	Colloquium	1
ME 590	Colloquium	1
Complete SARI (Scholarship and Research Integrity) training		
Culminating Experience		
A scholarly paper must be completed to meet the specific requirement of the culminating experience. This paper will demonstrate depth of knowledge to his/her adviser, a second reader, and the Director of the AMD Graduate Program.		
AMD 596	Individual Studies (Scholarly Paper) ²	3
Total Credits		30

¹ Note that AMD 596 cannot be used to fulfill this requirement.

² M.Eng. students can complete a three (3) credit course in one (1) semester.

³ The one-credit colloquium does not count toward the 30 graduate course credits required.

Culminating Experience

Candidates must write a culminating project paper on a topic mutually agreed upon with the adviser. Students will be encouraged to utilize their current employer to identify a relevant or practical problem of importance that additive manufacturing and appropriate design methods could address. The quality of the required paper is such that it must be suitable for publication in a professional journal or proceedings at a national or international conference, which generally requires a peer-review process.

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A minimum of 30 credits at the 400, 500, 600, or 800 level is required. At least 18 credits must be in 500-level courses.

Code	Title	Credits
Required Courses		
Complete the following 5 required courses that total 19 credits with a 19 grade point average of 3.00 or higher:		
EDSGN 562	Design for Additive Manufacturing	
ESC 545	Engineering and Scientific Principles of Additive Manufacturing	
IE 527	Additive Manufacturing Processes	
MATSE 567	Additive Manufacturing of Metallic Materials	
ME 566	Metal Additive Manufacturing Laboratory	
Complete a minimum of 8 credits of electives in 400 and/or 500 level courses. A listing of approved courses is maintained by the program. ¹		
Complete one credit of colloquium preferably in the first two semesters in the program. The following courses are offered to meet this requirement: ³		
EDSGN 590	Colloquium	
ESC 514	Engineering Science and Mechanics Seminar	
IE 590	I E Colloquium	
MATSE 590	Colloquium	
ME 590	Colloquium	
Complete SARI (Scholarship and Research Integrity) training		
Culminating Experience		
A scholarly paper or thesis must be completed to meet the specific requirement of the culminating experience. The paper or thesis will demonstrate depth of knowledge to his/her adviser, a second reader, and the Director of the AMD Graduate Program.		
AMD 596	Individual Studies (Scholarly Paper)	3-6
or AMD 600	Thesis Research	
Total Credits		30-33

¹ Note that AMD 596 cannot be used to fulfill this requirement.

² M.S. paper option students are required to complete one (1) credit in each of three (3) semesters.

³ The one-credit colloquium does not count toward the 30 graduate course credits required.

The M.S. degree scholarly paper option is designed to be completed in 3 semesters, or one calendar year (fall, spring, and summer). A research adviser will be assigned to students in their first semester. Students who need more time to complete the final paper will be allowed to complete

the paper, and have it reviewed and approved after the third semester has ended. Students are not required to remain in residence while they complete the final paper. However, extensions granted to students in this program must comply with the Graduate Council policy on deferred grades (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-400/grading-system/>). Students who choose the thesis option for their culminating experience are expected to take two years to complete the degree.

Culminating Experience

Candidates may choose a scholarly paper or thesis option to fulfill their culminating experience. Students who choose the scholarly paper option must write a culminating project paper on a topic mutually agreed upon with the adviser and register for 3 credits of AMD 596 to complete the paper. Students will be encouraged to utilize an industry internship or current employer to identify a relevant or practical problem of importance that additive manufacturing and appropriate design methods could address. The quality of the required paper is such that it must be suitable for publication in a professional journal or proceedings at a national or international conference, which generally requires a peer-review process.

Candidates who choose the thesis option must write and defend, at an oral examination, a thesis based upon original research in the field. The thesis will demonstrate depth of knowledge to his/her adviser, a second reader, and the Director of the AMD Graduate Program. Candidates must submit a thesis following the procedures specified by the Graduate School and register for 6 credits of AMD 600. The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School, and the student must pass the thesis defense.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/>)

gsad/gsad-900/gsad-901-graduate-assistants/) set by The Graduate School.

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Additive Manufacturing and Design (AMD) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/amd/>)

Learning Outcomes

Master of Engineering (M.Eng.)

1. **APPLY/CREATE** - Identify, formulate, and solve a relevant or practical problem of importance that additive manufacturing and design methods can address.
2. **COMMUNICATE** - Demonstrate proficiency in oral and written communication while addressing additive manufacturing and design ideas.
3. **THINK** - Critically analyze primary scientific literature to make sound engineering decisions.
4. **PROFESSIONAL PRACTICE** - Grow as leaders in manufacturing while maintaining the highest ethical standards in applying additive manufacturing to industry-relevant problems.
5. **KNOW** - Demonstrate an understanding of advanced core additive manufacturing principles.

Master of Science (M.S.)

1. **APPLY/CREATE** - Apply additive manufacturing approaches and frameworks to address relevant engineering challenges.
2. **PROFESSIONAL PRACTICE** - Effectively function in a multidisciplinary team-based environment.
3. **THINK** - Identify, analyze, and synthesize scholarly literature relating to the field of additive manufacturing.
4. **COMMUNICATE** - Articulate the value proposition for additive manufacturing in a given industry.
5. **KNOW** - Demonstrate foundational knowledge, critical thinking, and creativity in the uses of additive manufacturing and associated design methods.

Contact

Campus	University Park
Graduate Program Head	Allison Michelle Beese
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Allison Michelle Beese
Program Contact	Jaclyn Stimely Room 104, The 230 Building Penn State University University Park PA 16802 juc52@psu.edu (814) 863-8069
Program Website	View (http://AMDprogram.psu.edu)
Campus	World Campus
Graduate Program Head	Allison Michelle Beese
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Allison Michelle Beese
Program Contact	Jaclyn Stimely Room 104, The 230 Building Penn State University University Park PA 16802 juc52@psu.edu (814) 863-8069
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-additive-manufacturing-and-design-masters-degree/overview/)

Aerospace Engineering

Graduate Program Head	Amy Pritchett
Program Code	AERSP
Campus(es)	University Park (Ph.D., M.S., M.Eng.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Master of Engineering (M.Eng.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=AERSP)

Opportunities for graduate study are available in the following areas:

- low-speed aerodynamics
- airplane and helicopter aerodynamics
- V/STOL aircraft
- turbulence
- astrodynamics
- turbomachinery
- air breathing propulsion
- aeroacoustics
- gas dynamics
- stability and control of aerospace vehicles
- aerospace structures
- structural dynamics
- aeroelasticity

- rotorcraft engineering
- computational fluid dynamics
- experimental fluid dynamics
- space propulsion
- space vehicle dynamics
- high-performance computing

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The entering M.Eng. or M.S. student must hold a bachelor's degree in engineering, physical science, or mathematics, and may be required to complete (without degree credit) undergraduate course work in fluid and solid mechanics and intermediate mathematical analysis, if not already completed. The department will consider students with a 3.0 junior/senior grade-point average (GPA) on a 4.0 scale; students with special backgrounds, abilities, or interests may request a waiver to this GPA requirement. The best-qualified applicants will be accepted up to the number of spaces that are available.

Admission to the Ph.D. program requires satisfactory completion of a master's program in engineering, physical science, or mathematics. Admission to the Ph.D. program prior to completion of a master's degree may be considered upon the student passing the Ph.D. qualifying exam. A student must have completed at least 18 course credits beyond the baccalaureate degree in order to take the Ph.D. qualifying exam, and is not granted official status as a doctoral candidate until the comprehensive exam has been passed.

Degree Requirements

Master of Engineering (M.Eng.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Core Requirements

1. Basic field theory. Complete three courses for 9 credits, one from a prescribed list in each of the following categories: fluid dynamics, solid mechanics, and dynamics & control.
2. Applied mathematics. Complete one 3-credit, 500-level course from a prescribed list.
3. Teaching assistants and teaching aides who have classroom or laboratory instructional responsibilities must satisfactorily complete ENGR 888. Those with responsibilities limited to grading, holding office hours, and offering problem sessions must take ENGR 888 or a grading seminar.

The M.Eng. degree is a non-thesis professional master's degree. A total of 32 credits at the 400, 500, and 800 level is required, including courses in the core requirements. Students must take two credits of AERSP 590 Colloquium. A minimum of 18 credits must be taken at the 500 level, in addition to the two credits in AERSP 590. At least 18 credits in Aerospace Engineering courses are required in addition to AERSP 590. Students may count a maximum of 9 credits of 400-level course work toward the degree. Each student must either take the capstone course EDSGN 558 or complete a capstone project supervised by a member of the Graduate

Faculty, completed while enrolled in AERSP 596. The capstone project requires students to work individually or within a group on an aspect of aerospace engineering of their choosing. The project should demonstrate the ability of the student to integrate and apply concepts and techniques learned in the program courses.

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Core Requirements

1. Basic field theory. Complete three courses for 9 credits, one from a prescribed list in each of the following categories: fluid dynamics, solid mechanics, and dynamics & control.
2. Applied mathematics. Complete one 3-credit, 500-level course from a prescribed list.
3. Teaching assistants and teaching aides who have classroom or laboratory instructional responsibilities must satisfactorily complete ENGR 888. Those with responsibilities limited to grading, holding office hours, and offering problem sessions must take ENGR 888 or a grading seminar.

A total of 32 credits at the 400, 500, 600, and 800 level is required, including courses in the core requirements, with least 18 credits at the 500 and 600 level, combined. Fourteen credits must be in Aerospace Engineering courses, with at the least 8 credits at the 500 level. Students must take two credits of AERSP 590. Students may count a maximum of 6 credits of 400-level course work toward the degree. Six credits of thesis research (AERSP 600 or AERSP 610) are also required. A completed M.S. thesis and its public presentation is required for graduation. The thesis must be accepted by the student's advisers and/or committee members, the head of the graduate program, and the Graduate School.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Core Requirements

1. Basic field theory. Complete three courses for 9 credits, one from a prescribed list in each of the following categories: fluid dynamics, solid mechanics, and dynamics & control.
2. Applied mathematics. Complete one 3-credit, 500-level course from a prescribed list.
3. Teaching assistants and teaching aides who have classroom or laboratory instructional responsibilities must satisfactorily complete ENGR 888. Those with responsibilities limited to grading, holding office hours, and offering problem sessions must take ENGR 888 or a grading seminar.

There is no foreign language requirement for the Ph.D. degree; however, students must demonstrate proficiency in reading, writing, and speaking English through an examination administered by the department. This must be completed to satisfy the Graduate Council requirement before taking the comprehensive exam. The student's Ph.D. committee decides which, if any, courses are required in addition to those specified in the core requirements; this typically involves 24 course credits beyond the M.S. degree. Ph.D. students must also demonstrate evidence of experimental experience.

Over the course of a Ph.D. program, the department and Ph.D. committee administer three examinations: The qualifying examination is given as a preliminary aptitude test before the end of the second semester following admission to the program. A comprehensive examination, which covers the major and minor fields of study, is administered after the student has substantially completed the required course work. The final oral examination, which is related mainly to the dissertation, is given after the candidate has satisfied all other degree requirements. All Ph.D. students must maintain continuous registration until the dissertation is approved. A completed Ph.D. dissertation and its public defense (the Final Oral Examination) are required for graduation. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Aerospace Engineering (AERSP) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/aersp/>)

Learning Outcomes

Master of Engineering (M.Eng.)

1. Graduates will be able to demonstrate an understanding of advanced core principles and methods from selected sub-fields of Aerospace Engineering at a depth appropriate with their course of study.
2. Graduates will be able to analyze and synthesize knowledge within the field of Aerospace Engineering to address a complex problem of practical relevance.
3. Graduates will be able to apply their knowledge of selected sub-fields of Aerospace Engineering to formulate and solve engineering problems.
4. Graduates will be able to demonstrate high level of proficiency in oral and written communication.
5. Graduates will be able to demonstrate an understanding of, and a commitment to, the standards for scholarship and research integrity.

Master of Science (M.S.)

1. Graduates will be able to demonstrate an understanding of advanced core principles and methods from selected sub-fields of Aerospace Engineering at a depth appropriate with their course of study.
2. Graduates will be able to analyze and synthesize knowledge within the field of Aerospace Engineering to extend existing knowledge through a research experience.
3. Graduates will be able to apply their knowledge of selected sub-fields of Aerospace Engineering to formulate and solve engineering problems.
4. Graduates will be able to demonstrate high level of proficiency in oral and written communication.
5. Graduates will be able to demonstrate an understanding of, and a commitment to, the standards for scholarship and research integrity.

Doctor of Philosophy (Ph.D.)

1. Graduates will be able to demonstrate an understanding of advanced core principles and methods as well as modern research findings from different sub-fields of Aerospace Engineering at a depth appropriate for a Ph.D. candidate.
2. Graduates will be able to demonstrate the ability to analyze and synthesize appropriate literature, to critically review their work in context of the literature, and to formulate and defend conclusions based on their research that represent new scholarly findings.
3. Graduates will be able to apply their knowledge of selected sub-fields of Aerospace Engineering in formulating and executing a research plan.
4. Graduates will be able to demonstrate high level of proficiency in oral and written communication.
5. Graduates will be able to demonstrate an understanding of, and a commitment to, the standards for scholarship and research integrity.

Contact

Campus	University Park
Graduate Program Head	Amy Ruth Pritchett
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Jacob Willem Langelaaan
Program Contact	Lindsay Moist 229 Hammond Building University Park PA 16802 lnm3@psu.edu (814) 865-6997
Program Website	View (http://www.aero.psu.edu/)

African American and Diaspora Studies

Graduate Program Head	Wanda Knight
Program Code	AFAMD
Campus(es)	University Park
Degrees Conferred	Dual-Title
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=AFAMD)

Students electing this program through participating departments will earn a degree with a dual-title at the Ph.D. level, i.e., Ph.D. in (graduate program name) and African American and Diaspora Studies.

The following graduate programs offer a dual-title Ph.D. degree in African American and Diaspora Studies: Art Education, Communication Arts and Sciences, English, History, Philosophy, and Political Science.

The primary objective of the dual-title degree program in African American Studies is to expand teaching, research, and scholarship on the nearly one billion people of African descent scattered across several regions of the world. As a program committed to integrating knowledge produced across disciplines and to crediting the importance of historical considerations, it will reinforce and broaden the knowledge that students acquire and that scholars typically cultivate in the traditional disciplines. This is accomplished through partnerships with allied disciplines, such as History, Political Science, Philosophy, English, Comparative Literature, and Art Education. Graduate students are trained to describe, analyze, and evaluate the practices, phenomena, and policies that both issue from and structure the experiences and possibilities of African-descended peoples in the Americas and in African diasporic populations around the world. Students in more traditional disciplines such as English or History who want to acquire formal knowledge about African Americans and the African Diaspora beyond what is offered by their home departments will be able to acquire that knowledge through the seminars offered in this program. The program aims to produce Penn State doctoral graduates with a competitive advantage for African American and Diaspora Studies-related employment in academia and elsewhere.

Admission Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

For admission to the dual-title Ph.D. degree under this program, a student must first apply and be admitted to an approved partnering graduate program. Once accepted by the partnering graduate program, the student can apply to the African American and Diaspora Studies Admissions Committee, which will be composed of Graduate Faculty in the Department of African American Studies. The application must include a statement of purpose that addresses how the student's research and professional goals intersect with the objectives of the dual-title graduate degree program in African American and Diaspora Studies. The Admissions Committee reviews applications and recommends students for admission to the dual-title PhD program in African American and Diaspora Studies.

Students may apply to the dual-title program when they request admission to the partner department, or at any time prior to taking the qualifying exam in the primary graduate program, provided that they secure the approval of the graduate director of the partner department. Practically speaking, this will likely mean applying to the dual-title program before completing the second year of study in the partner department. Students applying to the dual-title degree program should be aware that participating in a dual-title program may require additional time to complete the degree; students should plan ahead to secure sufficient funding.

The African American and Diaspora Studies dual-title graduate degree program will follow the timetable and admission requirements of its partnering graduate programs.

GPA and GRE Requirements

Applicants entering with only an undergraduate degree should have a junior/senior cumulative average of at least 3.00 (on a 4.00 scale), and, where applicable, a minimum GPA of 3.50 for all graduate work previously undertaken. Exceptions to the minimum GPA requirement may be made for students with special backgrounds, abilities, and interests. Each applicant must submit the scores of the Graduate Record Examination (GRE) taken within five years previous to the date of application.

Degree Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

The minimum course requirements for this dual-title Ph.D. degree are as follows: 15 credits of course work related to African American and Diaspora Studies, all at the 500 level or above. Of these 15 credits, 9 must come from the required core course sequence in African American and Diaspora Studies, which comprises the following courses:

Code	Title	Credits
Required Courses		
AFAM 501	Seminar in African American Studies	3
AFAM 502	Blacks and African Diaspora	3
AFAM 503	Sexual and Gender Politics in the African Diaspora	3

Students must also take 6 elective credits, all of which must come either from the list below or otherwise have the prior approval of African American and Diaspora Studies supervising faculty. Over time, additional courses may be added to the list of acceptable electives. The director of graduate studies in the Department of African American Studies will maintain a comprehensive list of approved courses. Particular courses may simultaneously satisfy requirements in History and in African

American and Diaspora Studies. Students who already hold a master's degree from another institution may petition to have up to 6 equivalent course credits recognized.

Code	Title	Credits
Electives		
Select 6 credits of the following electives:		6
AFR 501	Key Issues in African Studies	
PHIL 539	Critical Philosophy of Race	
HIST 547	Slavery in the Americas	
HIST 551	The African American Freedom Struggle	
HIST 572	Race and Nation in Modern Latin America	
ENGL 565	Period Studies in African-American Literature	
ENGL 566	Genre Studies in African-American Literature	
ENGL 567	Thematic Studies in African-American Literature	
ENGL 568	Gender Issues in African-American Literature	

Language Requirements

Communication and foreign language requirements will be determined by the academic advisers from the primary department.

qualifying examination

The dual-title field must be fully integrated into the qualifying exam for the doctoral program. In addition, students in the dual-title Ph.D. in African American and Diaspora Studies will be required to present to their committee a portfolio of work in African American and Diaspora Studies which includes a statement of the student's interdisciplinary research interests, a program plan, and samples of writing that indicate the student's interest in questions taken up by scholars of African American and Diaspora Studies.

Ph.D. committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), at least one member of the Ph.D. committee must be a member of the African American and Diaspora Studies Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair is not faculty in African American and Diaspora Studies, then the committee member representing African American and Diaspora Studies must be appointed as co-chair.

Comprehensive Exams

The African American and Diaspora Studies Graduate Faculty member on the student's committee is responsible for developing and administering the African American and Diaspora Studies portion of the student's comprehensive exams. The exam must incorporate written and oral components in African American and Diaspora Studies based on the student's thematic or regional area of interest and specialization in African American and Diaspora Studies. The African American and Diaspora Studies portion of the exam will include the following components: broad history of the field, contemporary theory and debates, and either sexual and gender politics or a topic related to the student's specific area of interest.

Dissertation

The candidate must complete a dissertation and pass a final oral examination (the dissertation defense) on a topic that reflects their original research and education in both the primary discipline and African

American and Diaspora Studies in order to earn the dual-title Ph.D. degree.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

African American Studies (AFAM) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/afam/>)

Contact

Campus	University Park
Graduate Program Head	Wanda Knight
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Raymond Keith Gilyard
Program Contact	Ashley Marie Scott 345C Willard Building Pennsylvania State University University Park PA 16802 ams87@psu.edu (814) 865-2484
Program Website	View (http://afam.la.psu.edu/)

African Studies

Graduate Program Head	Sinfree Makoni
Program Code	AFRST
Campus(es)	University Park
Degrees Conferred	Dual-Title
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=AFRST)

Students electing this program through participating departments will earn a degree with a dual-title at the Ph.D. level, that is, a Ph.D. in (graduate program name) and African Studies.

The following graduate programs offer dual-title Ph.D. degrees in African Studies: Comparative Literature, French, Geography, and Political Science.

The primary objective of the dual-title degree program in African Studies is to expand teaching, research, and scholarship on Africa and African societies at Penn State. This is accomplished by providing multidisciplinary training for Penn State doctoral students, who are undertaking graduate studies on Africa-related topics in a number of allied disciplines, such as geography, history, political science, sociology, comparative literature, public health, forestry, agricultural sciences, and international studies. The program complements training on Africa for graduate students in other areas such as business, law, and engineering. The program provides these various disciplines with an intellectual and physical location at which their African scholarship can be put to the most effective use. The program uses the research projects and institutional networks of core and affiliate African Studies Graduate Faculty to provide research opportunities and links in Africa for Penn State doctoral students. The program aims to produce Penn State doctoral graduates, who have a comparative advantage for African Studies-related employment in academia, bilateral and multilateral agencies and international think-tanks.

Admission Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Students must apply and be admitted to the primary graduate program and the Graduate School before they can apply for admission to the dual-title degree program. Applicants interested in the dual-title degree program may make their interest in the program known clearly on their applications to the major program and include remarks in their statement of purpose that address the ways in which their research and professional goals reflect an interest in African Studies-related research.

To be enrolled in the Dual Title Doctoral Degree Program in African Studies, a student must submit a letter of application and transcript, which will be reviewed by an African Studies Admissions Committee. An applicant must have a minimum grade point average of 3.0 (on a 4 point scale) to be considered for enrollment in the dual-title degree program. Students must apply for enrollment into the dual-title degree program in African Studies prior to taking the qualifying examination in their primary program.

Degree Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

The Dual-Title Doctoral Degree in African Studies is awarded to students who are admitted to a Ph.D. program that has adopted the dual-title degree program in African Studies. The minimum course requirements are as follows.

Code	Title	Credits
Required Courses		
AFR 501	Key Issues in African Studies	3
or AFR 505	African Studies Methodology	
15 credits of Africa-centered coursework at the 400 or 500-level:		15
<ul style="list-style-type: none"> • a minimum of 6 of these credits must be taken from a list of courses maintained by the African Studies program chair • as many as 6 of the 15 credits may come from other units as approved by the Director of Graduate Studies in the African Studies Program • no more than 6 credits may be taken at the 400-level and no more than 6 combined credits may come from individual studies courses and/or foreign studies courses 		
Communication and foreign language requirements will be determined by the student and the academic advisers and the African Studies Program		
Total Credits		18

The choice of electives in African Studies is to be proposed by the student and is subject to approval by the academic advisers from the primary program and the African Studies Program. The suite of selected courses should have an integrated, intellectual thrust that probes a thematic, national or regional issue and that is complementary to the student's specialty in the primary program.

Language Requirement

The language requirement for the dual-title degree program is determined by the academic advisers in the primary program and the African Studies Program, in accordance with the existing language requirements of the primary program.

qualifying Examination

The dual-title degree is guided by the Qualifying Exam procedure of the primary program. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable. There will be a single qualifying examination, containing elements of both the major discipline and African Studies.

Ph.D. committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the committee must include at least one member of the African Studies Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. The chair of the committee is typically from the primary program. If the chair is not also

a member of the Graduate Faculty in African Studies, the member of the committee representing African Studies must be appointed as co-chair.

Comprehensive Examination

After completing all course work, doctoral students must pass a comprehensive examination that includes written and oral components. Written components are administered in the student's primary discipline and in African Studies. The African Studies representative on the student's Ph.D. committee develops questions for and participates in the evaluation of the comprehensive examination. The African Studies component of the exam is based on the student's thematic, national or regional area of interest and specialization in African Studies.

Dissertation and Dissertation Defense

Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. Students enrolled in the dual-title program are required to write and orally defend a dissertation on a topic that reflects their original research and education in both the primary discipline and African Studies.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

African Studies (AFR) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/afr/>)

Learning Outcomes

- Graduates will demonstrate command of historical and current socioeconomic developments of Africa.
- Graduates will demonstrate command of applying social science and humanities methodologies in the advancement of knowledge about Africa's broad socioeconomic developments.
- Graduates will demonstrate the ability to effectively communicate major issues in the study of Africa.
- Graduates will have command of critical thinking and interdisciplinary analysis of developments in Africa.
- Graduates will master the highest ethical standards required in conducting research and in applying their discipline.

Contact

Campus	University Park
Graduate Program Head	Sinfree Bullock Makoni
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Mathias Hanses
Program Contact	Ashley Marie Scott 345C Willard Building University Park PA 16802 ams87@psu.edu (814) 865-2484
Program Website	View (http://afr.la.psu.edu/)

Agricultural and Biological Engineering

Graduate Program Head	Suat Irmak
Program Code	ABENG
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Dual-Title Ph.D. and M.S. in Agricultural and Biological Engineering and International Agriculture and Development Dual-Title Ph.D. and M.S. in Agricultural and Biological Engineering and Operations Research
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=ABENG)

Agricultural and Biological Engineering (ABENG) offers students the opportunity to gain expertise in several areas that relate to the world's most important sociotechnological and sustainability challenges including energy, environment, crop/food production and health. Specific focus areas include agricultural machinery, mechatronics, remote sensing, natural resources, water quality, climate change, fermentation, food production, food safety, biological and agricultural bioproducts, life cycle analysis and techno-economic analysis. The ABENG M.S. degree is research based and requires a thesis.

Excellent facilities, including equipment and instrumentation, are available for research. Extensive additional fabrication and characterization equipment and facilities are available through Penn State institutes and user facilities including the Institutes of the Environment and Energy, Huck Institutes of the Life Sciences, Materials Research Institute, Materials Characterization Laboratory, Nanofabrication Facility, Institute for CyberScience, PA Housing Research Center, Center for Food Manufacturing, USDA Pasture Systems and Watershed Management Research Lab, Mushroom Research and Demonstration Facility and a 1,500-acre agricultural research center for cooperative work with agronomic and horticultural production systems as well as animal production systems.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

An undergraduate major in engineering is normally a prerequisite to work in the major. Students without an undergraduate engineering degree will be considered for admission on a provisional basis (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/provisional-admission/>) pending the completion of a number of additional credits to be specified on an individual basis. These additional credits will not count towards the program degree requirements.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

All applicants must provide the department with official transcripts from all post-secondary institutions attended (<http://gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>), as well as a statement of purpose written by the applicant, and at least three letters of recommendation. Admission into the Agricultural and Biological Engineering Graduate Program is based upon a thorough review of all applicant qualifications, and the best-qualified applicants will be accepted up to the number of students for which department resources are available. GRE scores will not be accepted.

Master of Science (M.S.)

Completion of an undergraduate degree in agricultural or biological engineering or in another related engineering discipline is required for direct admission to the Agricultural and Biological Engineering Graduate Program. Students need at least a 3.0 (4.0 base) junior/senior grade-point average to be considered for admission.

A student with an undergraduate degree in a non-engineering field can be admitted to the M.S. program on a provisional basis (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/provisional-admission/>), pending the completion of a number of additional credits to be specified on an individual basis. These additional credits will not count towards the M.S. degree requirements. The provisional status continues until completion of the engineering undergraduate requirements in mathematics, physics, engineering sciences and any additional required 400-level Biological Engineering

courses. Upon completion of these preparatory courses with a minimum grade-point average of 3.0, the student will be admitted to the graduate program.

Doctor of Philosophy (Ph.D.)

The program requirement for acceptance to graduate study toward a Ph.D. degree in Agricultural and Biological Engineering is an M.S. degree with research thesis in an engineering or science discipline with a B.S. degree from an engineering program. Outstanding students interested in direct admission from a B.S. engineering program to the Ph.D. Program should contact the Graduate Program Coordinator. Direct admission will be based on critical evaluation of the student's potential to conduct publishable research, academic record, statement of purpose, and reference letters. Students who apply directly to the Ph.D. program but are not qualified will be considered for admission into the M.S. program.

A student with an undergraduate degree in a non-engineering field can be admitted to the Ph.D. program on a provisional basis (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/provisional-admission/>), pending the completion of a number of additional credits to be specified on an individual basis. These additional credits will not count towards the Ph.D. degree requirements. The provisional status continues until completion of the engineering undergraduate requirements in mathematics, physics, engineering sciences and any additional required 400-level Biological Engineering courses. Upon completion of these preparatory courses with a minimum grade-point average of 3.0, the student will be admitted to the graduate program.

Degree Requirements

Master of science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A minimum of 30 credits at the 400, 500, 600, or 800 level is required, with at least 18 credits at the 500 and 600 level, combined. A minimum of 12 credits in course work (400, 500, and 800 series) must be completed in the major program (BE or ABE). A thesis is required and a minimum of 6 credits in thesis research (600 or 610) must be completed. The thesis must be accepted by the advisers, committee members, the head of the graduate program, and the Graduate School, and the student must pass a thesis defense.

Each M.S. program of study must meet the following requirements:

Code	Title	Credits
ABE 500	Research Methods	3
BRS 502	Human Behavior and ethics in Management and Technology (or other Ethics course from a list of approved courses maintained by the program office.)	3
	One 500-level STAT course	3
ABE 590	Colloquium (1 credit per semester for 3 semesters)	3
	Additional 400-level BE courses (limit 3 credits), 500-level or 800-level ABE courses	6
ABE 600	Thesis Research	6
	Additional 400, 500, or 800-level courses or ABE 600 Thesis Research	6
Total Credits		30

In addition to the above listed course work requirements, every graduate student must fulfill the Scholarship and Research Integrity (SARI) requirement. SARI requirement consists of two parts: 1) completion of ABE 500 with a grade of B or better and 2) completion of online training program at: <http://www.research.psu.edu/training/sari> (<http://www.research.psu.edu/training/sari/>) Responsible Conduct of Research (RCR) for Engineers. The online SARI requirement must be completed within one year from date of enrollment in the program of study. A copy of the completion certificate of the online SARI training program should be given to the Graduate Administrative Assistant. This will be placed in the student's department folder.

A minimum grade point average of 3.00 is required for graduation. Only grades of C or better are accepted for graduate credit. All courses must be approved by the Advisory Committee as having significance and value for the degree program. All requirements for M.S. degree, whether satisfied on this campus or elsewhere, must be met within eight years from the first semester of graduate study.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Ph.D. degree requirements include successful completion of the following: approved graduate course work, a qualifying examination, English Competence requirements, a comprehensive examination, and a final oral examination (the dissertation defense). To earn the Ph.D. degree, doctoral candidates must write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Each Ph.D. program of study, for students holding a masters level engineering degree, must meet the following requirements (courses taken previously do not have to be repeated, except ABE 590):

Code	Title	Credits
ABE 500	Research Methods (unless previously taken)	3
BRS 502	Human Behavior and ethics in Management and Technology (or other ethics course from a list of approved courses maintained by the program office, unless previously taken)	3
ABE 590	Colloquium (1 credit per semester for 4 semesters)	4
	500 and/or 800-level ABE courses (excluding ABE 500, 590-596) ¹	6
EDCE 530	Teaching and Learning in Agricultural Science (B grade minimum) ²	3
ABE 602	Supervised Experience in College Teaching	1-3
	Communications ²	3
	Additional course work as approved by the Ph.D. Committee	

¹ One 500-level ABE course (3 credits) and one engineering graduate (500-level) course (3 credits) from the list of approved courses maintained by the program office fulfills this requirement.

² B- does not mean this requirement.

Except as specified above, no particular course levels, total number of courses or total credits are required by the department. The Dissertation committee will determine the minimum requirements in such supporting areas as mathematics, engineering, agricultural/biological sciences, and physical sciences. The candidate is expected to develop a program of

study and submit it to the Dissertation Committee for consideration and approval.

In addition to the above listed course work requirements, every graduate student must fulfill the Scholarship and Research integrity (SARI) requirement. SARI requirement consists of two parts: 1) completion of ABE 500 with a grade of B or better, and 2) completion of online training program at <http://www.research.psu.edu/training/sari>- Responsible Conduct of Research (RCR) for Engineers. The online SARI requirement must be completed within one year from date of enrollment in the program of study. A copy of the completion certificate of the online training program should be given to the Graduate Administrative Assistant. This will be placed in the student's department folder.

It is expected that each Ph.D. student not holding an M.S. engineering degree will satisfy the intent of the M.S. degree coursework requirements specified elsewhere in this document. Research credits (ABE 600) are in addition to coursework credits.

All requirements for a Ph.D. degree must be completed within eight years after passing the Qualifying Examination.

A Ph.D. candidate is not required to have a minor field of study. However, if the student selects a minor field, the minor must consist of not fewer than 15 graduate credits above and beyond any credits used for a master's minor. The coursework must be distinct from the student's primary academic and research focus regardless of the course abbreviation/prefix. All credits must be approved by the graduate major program and graduate minor program heads. The minor must meet Graduate Council policy requirements listed under GCAC-611 Minor – Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>).

Dual-titles

Dual-Title M.S. and Ph.D. in Agricultural and Biological Engineering and International Agriculture and Development

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Graduate students with research and educational interests in international education may apply to the dual-title program in Agricultural and Biological Engineering and International Agriculture and Development. The goal of the dual-title program in ABENG and INTAD is to enable graduate students from ABENG to acquire the knowledge and skills of their primary area of specialization in ABENG, while at the same time gaining the perspective and methods needed for work in the international agriculture. Graduate study in this program seeks to prepare students to assume leadership roles in science, engineering, outreach, and project management anywhere in the world. Students acquire a broad perspective on how to apply their research findings in the context of the broader international community. Thus, the dual-title will allow students to master their field of specialization from an international perspective so that they can effectively engage in agricultural development activities within various countries and regions.

Admission Requirements

Students must apply and be admitted to the graduate program in ABENG and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students

must apply for admission to and meet the admissions requirements of the INTAD dual-title program. Refer to the Admission Requirements section of the INTAD Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/international-agriculture-development/>). Doctoral students must be admitted into the dual-title degree program in INTAD prior to taking the qualifying examination in their primary graduate program.

Degree Requirements for the Dual-Title M.S.

To qualify for the dual-title degree, students must satisfy the degree requirements for the M.S. degree, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual-title M.S. in INTAD, listed on the INTAD Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/international-agriculture-development/>). Up to 6 credits of INTAD approved courses can be applied to fulfilling ABENG program requirements. Final course selection must be approved by the student's advisory committee.

Degree Requirements for the Dual-Title Ph.D.

To qualify for the dual-title degree, students must satisfy the degree requirements for the Ph.D. degree, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual-title Ph.D. in INTAD, listed on the INTAD Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/international-agriculture-development/>). Some courses may satisfy both ABENG program requirements and those of the INTAD program. Up to 6 credits of INTAD approved courses can be applied to fulfilling ABENG program requirements. Final course selection must be approved by the student's Ph.D. committee.

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from ABENG and must include at least one Graduate Faculty member from the INTAD program. Faculty members who hold appointments in both programs' Graduate Faculty may service in a combined role. There will be a single qualifying examination, containing elements of both ABENG and INTAD. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed on semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of an ABENG and INTAD dual-title Ph.D. student must include at least one member of the INTAD Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may service in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in INTAD, the member of the committee representing INTAD must be appointed as co-chair. The INTAD representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in ABENG and INTAD. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title M.S. and Ph.D. in Agricultural and Biological Engineering and Operations Research

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Graduate students with interests in operations research may apply to the dual-title program in Agricultural and Biological Engineering and Operations Research. The goal of the dual-title program in ABENG and Operations Research is to enable graduate students from ABENG to acquire the knowledge and skills of their primary area of specialization in ABENG, while at the same time gaining the perspective and methods needed for work systems analysis and modeling. Graduate study in this program seeks to prepare students to utilize the tools, techniques, and methodology of operations research, while maintaining a close association with areas of application. Operations research is the analysis—usually involving mathematical treatment—of a process, problem, or operation to determine its purpose and effectiveness and to gain maximum efficiency.

Admission Requirements

Students must apply and be admitted to the graduate program in ABENG and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the OR dual-title program. Refer to the Admission Requirements section of the OR Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>). Doctoral students must be admitted into the dual-title degree program in OR prior to taking the qualifying examination in their primary graduate program.

Degree Requirements for the Dual-Title M.S.

To qualify for the dual-title degree, students must satisfy the degree requirements for the M.S. degree, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual-title M.S. in OR, listed on the OR Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>). Up to 6 credits of OR approved courses can be applied to fulfilling ABENG program requirements. Final course selection must be approved by the student's advisory committee.

Degree Requirements for the Dual-Title Ph.D.

To qualify for the dual-title degree, students must satisfy the degree requirements for the Ph.D. degree, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual-title Ph.D. in OR, listed on the OR Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>). Some courses may satisfy both ABENG program requirements and those of the OR program. Up to 6 credits of OR approved courses can be applied to fulfilling ABENG program requirements. Final course selection must be approved by the student's Ph.D. committee.

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from ABENG and must include at least one Graduate Faculty member from the OR program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both ABENG and OR. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed on semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of an ABENG and OR dual-title Ph.D. student must include at least one member of the OR Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in OR, the member of the committee representing OR must be appointed as co-chair. The OR representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in ABENG and OR. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Agricultural and Biological Engineering (ABE) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/abe/>)

Learning Outcomes

Master of Science (M.S.)

1. **KNOW:** Graduates will be able to demonstrate mastery of core principles and methods of agricultural and biological engineering professional practice and in-depth mastery of a subfield.
2. **THINK:** Graduates will be able to critically and creatively conceptualize and evaluate engineering problem formulations, analyses, and solutions.
3. **APPLY/CREATE:** Graduates will demonstrate proficiency in engineering problem formulation, planning, organization and implementation of appropriate methods of analyses and solutions.
4. **COMMUNICATE:** Graduates will be able to effectively communicate technical knowledge, including ideas, data analysis, findings, or decision justification in written and oral presentation appropriate to the audience.
5. **PROFESSIONAL PRACTICE:** Graduates will demonstrate knowledge of, and ability to, practice the professional standards of engineering and professional behavior. Graduates will demonstrate a knowledge of ethics, equity, diversity and inclusivity and the application of these concepts and principles to the profession and to relevant social issues.

Doctor of Philosophy (Ph.D.)

1. **KNOW:** Graduates will demonstrate a deep knowledge of principles and methodologies of agricultural and biological engineering which may include the foundational mathematics, physics, chemistry, biology, engineering or communications.
2. **CREATE:** Graduates will be able to create new knowledge and develop new solutions to agricultural and biological engineering problems by developing an understanding of the scientific and engineering literature and engaging in scientific research.
3. **APPLY:** Graduates will be able to apply knowledge of the principles and methodologies of agricultural and biological engineering to the process of creating new knowledge and conducting original scientific research in the field of agricultural and biological engineering.
4. **THINK:** Graduates will be able to independently analyze and critique motivations for conducting research, the research process, research results, and the implications of research and its results to our world.
5. **COMMUNICATE:** Graduates will be able to actively listen, convey accurately and clearly ideas and results both orally and in writing, and engage in positive, effective deliberation.
6. **PROFESSIONAL PRACTICE:** Graduates will be prepared to become leaders in our society by being able to apply technical skills for effective decision making in agricultural and biological engineering fields. Graduates will demonstrate a knowledge of ethics, equity, diversity and inclusivity and the application of these concepts and principles to the profession and to relevant social issues.

Contact

Campus	University Park
Graduate Program Head	Suat Irmak
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Ali Demirci
Program Contact	Kristen C. Greskovic 105 Agricultural Engineering Building University Park PA 16802 kcg107@psu.edu (814) 863-1524
Program Website	View (http://abe.psu.edu/graduateprograms/)

Agricultural and Environmental Plant Science

Graduate Program Head	Erin Connolly
Program Code	AEPS
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Dual-title Ph.D. and M.S. in Agricultural and Environmental Plant Science and International Agriculture and Development
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=AEPS)

The graduate program in Agricultural and Environmental Plant Science emphasizes research that increases the efficiency of production of agronomic and horticultural crops, improves the quality of food, feed, and fiber available for humans and animals, develops an understanding of the basic soil-plant-animal climate complex of which humans are a part, and improves the overall quality of the human environment. Within this framework, students may specialize in various disciplinary foci related to horticultural or agronomic crops including turfgrass. Specialties include plant breeding, genetics, and genomics, agricultural ecology, ecophysiology, management of cropping systems, plant nutrition, root/soil interactions including microbiomes, plant physiology, international agriculture, abiotic stress biology, climate resilience, plant molecular biology and biotechnology, horticultural crop marketing, pomology, viticulture, vegetable production, and weed science.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Applicants should have a B.S., B.A. or comparable degree in agricultural or biological sciences with strong academic performance. Students from other majors will be considered provided they have academic background that includes biological sciences, chemistry, and mathematics. Expected course background varies with the intended area of concentration, but botany or plant science courses, statistics, soils, and chemistry are recommended. Students who lack some of the prerequisite courses

may be provisionally admitted (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-303-provisional-admission/>) but may be required to take these courses without degree credit. Ph.D. applicants should have a M.S. degree in a related field or significant research experience.

Scores from the Graduate Record Examination (GRE) general tests are not required for admission.

A minimum junior/senior grade-point average 3.00 (on a 4.00 scale) is required in all courses in the biological and physical sciences. Exceptions to these requirements may be made for students with special backgrounds, abilities, and interests.

Applicants must submit a statement of interests and goals and three letters of reference.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A minimum of 30 credits at the 400, 500, 600, or 800 level is required, with least 18 credits at the 500 and 600 level, combined. Students are required to complete a thesis and at least 6 credits in thesis research (AEPS 600 or AEPS 610) must be included in the program.

Code	Title	Credits
Required Courses		
AEPS 502	Current Issues in Agricultural Innovation	2
AEPS 515	Professional Development for the Plant Sciences	3
AEPS 555	Effective Scientific Communications	3
AEPS 602	Supervised Experience in College Teaching (Any time) ¹	1
AEPS 590	Colloquium	1
Electives		
Choose appropriate course in statistical methods course at 400-800 level. (By the end of the third semester)		3
Choose from 400-800 level courses in AGRO, AEPS, BIOL, ENT, FOR, HORT, INTAD, PLBIO, PPATH, PPEM, SOILS, STAT or related areas with approval of advisory committee. (All semesters)		13
Other Requirements		
Proposal meeting - Proposal presentation to committee, competency evaluation, and approval of course work plan. (By the end of the second semester)		
SARI Training		
2-hour workshop		
1 hour completed in AEPS 502		
3 hours completed in AEPS 515		
Culminating Experience		
AEPS 600	Thesis Research (Any time)	6
Final oral exam - Administered by committee. (Final semester)		
Total Credits		31

¹ Even though one credit of AEPS 602 is required, it cannot be counted towards fulfilling the credit requirement for the degree.

M.S. Student Advisory Committee

The M.S. student advisory committee must consist of three members of the Graduate Faculty, one of whom must be outside the major program.

Proposal presentation

A written research outline (including hypothesis, objectives, and methods) should be delivered to each member of the committee at least one week before the proposal meeting. The student will present the research plan at the meeting for discussion and recommendations by members of the advisory committee. Changes agreed upon by the committee members, adviser, and student will be incorporated in a revised research plan. If a new draft is required, it will be completed within one month of the meeting. Subsequent revisions of the plan may be accomplished by consulting committee members individually. Copies of each revision will be distributed to committee members for their concurrence.

Competency evaluation

A competency evaluation will be held as part of the proposal meeting. The advisory committee will determine the student's strengths and weaknesses in subject areas relevant to the proposed research and the professional goals of the candidate. Committee members will ask specific questions related to the proposed research and evaluate the competency of the student to pursue the M.S. degree. Students may (1) pass with or without additional recommended course work; (2) have an opportunity for a second evaluation; (3) be asked to leave the program.

Approval of course work plan

The advisory committee will consider the course work plan in the context of the student's prior preparation, performance on the competency evaluation, and professional goals. The committee may approve the plan as presented or require additional courses.

Teaching experience

A teaching experience is required of all M.S. students in the Department of Plant Science. This experience shall consist of one semester of assistance with one section of a course documented by at least one credit of AEPS 602. (*NOTE: Even though one credit of AEPS 602 is required, it cannot be counted towards fulfilling the credit requirement for the degree.*) Equivalent teaching experience completed outside of the Department may be substituted for this requirement. Students may waive this requirement only by written concurrence of the Thesis Adviser, Graduate Program Director, and Department Head.

Final oral exam

The final oral exam will be based on the student's written thesis, which should be distributed to the advisory committee at least one week before the final exam. The student should be able to marshal satisfactory defense of the methods, findings, and conclusions of the thesis, be able to relate the findings to pertinent literature, and demonstrate acceptable knowledge in the major and minor fields.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Code	Title	Credits
Required Courses		
AEPS 502	Current Issues in Agricultural Innovation	2
AEPS 515	Professional Development for the Plant Sciences	3
AEPS 555	Effective Scientific Communications	3

AEPS 602	Supervised Experience in College Teaching (Any time)	2
AEPS 590	Colloquium (Final semester)	1

Electives

Choose appropriate course in statistical methods at 400-800 level. (1st-3rd semester)	6
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Choose from 400-800 level courses in AGRO, AEPS, BIOL, ENT, FOM, HORT, INTAD, PLBIO, PPATH, PPEM, SOILS, STAT or related areas with approval of advisory committee. (Complete most course work before the comprehensive exam)

Other Requirements

Qualifying exam - Oral exam, includes evaluation of English competency, conducted by intended committee members. (Within 3 semesters of enrolling)

Proposal meeting - Proposal presentation to dissertation committee and approval of course work plan. (1st-3rd semester, after passing qualifying exam)

SARI training

2-hour workshop

1 hour completed in AEPS 502

3 hours completed in AEPS 515

Comprehensive exam - written and oral exams. (After most course work is complete but more than 3 months before intended graduation)

Culminating Experience

AEPS 600	Thesis Research (Any time)	Variable
or AEPS 601	Ph.D. Dissertation Full-Time	

Dissertation defense (Final semester)

Total Credits **17**

Qualifying exam

The purpose of the qualifying examination is to assess whether the student is capable of conducting doctoral research based on critical thinking, basic intellect, attitude, and previous training. The oral examination will be administered by the prospective Ph.D. committee. At the beginning of the exam, the candidate will make a 15-minute oral presentation summarizing a journal article. Each member of the committee will ask questions of the candidate and rate the candidate's performance.

English Competency Evaluation

English competency will be evaluated as part of the qualifying exam. The prospective candidate will write a summary and critique of a journal article provided by the adviser, which will be submitted to the full committee one week before the oral qualifying exam. At the oral qualifying exam, the student will present the summary and critique to the committee and answer questions from committee members about the written and oral critique and other subjects relevant to the student's intended course of study. Committee members will then determine whether the student should take additional courses or actions to improve English competency.

The Ph.D. committee

The Ph.D. committee must meet all Graduate Council requirements; refer to GCAC-602 Ph.D. Committee Formation, Composition, and Review – Research Doctorate (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>).

Teaching experience

A teaching experience is required of all Ph.D. students in the Department, accompanied by registration for AEPS 602 (1 credit). This requirement is independent of the requirement at the master's level. Equivalent teaching experience completed outside of the Department may be substituted for this requirement. Students may waive this requirement only by written concurrence of the dissertation adviser, Graduate Program Director, and the Department Head.

Proposal meeting

The student will prepare a written research outline (including hypothesis, objectives, and methods) for presentation to and approval by the Ph.D. committee. A copy of the proposal should be delivered to each member of the committee at least one week before the scheduled meeting. The Ph.D. committee will suggest changes to be considered by the student and the dissertation adviser. At the conclusion of the Dissertation Research Proposal Presentation and Approval meeting, each committee member must rate the student's dissertation proposal. If a new draft of the research proposal is required, it must be completed within one month of the proposal meeting. Copies of the revision should be distributed to committee members for their concurrence.

Comprehensive exam

The objective of the comprehensive exam is to determine if the student has attained a level of training in the major and minor fields with sufficient depth and breadth to be worthy of the Ph.D. degree upon submitting an acceptable dissertation.

The comprehensive will be given when, in the student's and the dissertation adviser's opinion, the student is ready for the examination and when the communications and English competency requirements and essentially all of the coursework (including at least 12 credits of AEPS 600/AEPS 610) have been completed. The examination will include written and oral segments.

Each Ph.D. committee member will prepare a written set of questions to be completed by the student. Not more than three hours will be allowed for each member's questions and not more than two sets may be completed per day. Each committee member shall review the student's answers and provide an evaluation to the student and the Ph.D. committee within one week after the examination. The written examination and evaluation shall be completed at least one week but not more than four weeks prior to the date of the oral examination. All committee members who are members of the Graduate Faculty in AEPS must give both written and oral examinations. Those who are not members of the Graduate Faculty in AEPS may at their discretion omit the written examination and defer all questions to the oral examination.

The oral examination shall be administered by the entire Ph.D. Committee. Each committee member will have approximately 30 minutes to question the student. At the end of the examination each committee member will be asked to rate the candidate's performance on both the written and oral portions of the exam.

A favorable vote of at least two-thirds of the members of the committee is required for passing a comprehensive or final oral examination. If a student fails an examination, the Ph.D. committee will determine whether the student will be granted a second opportunity to take the examination.

Final oral examination

The final oral examination will be a defense of the dissertation before the full Ph.D. committee. The Ph.D. committee will be provided with a copy of the dissertation at least two weeks before the final oral examination. During the final exam, the student will make a public presentation

summarizing the dissertation, followed by a period of questions from the committee relating primarily to the dissertation. The committee members will evaluate the student's performance during the exam and the quality of the dissertation and determine whether the student passes the final exam. A favorable vote by two-thirds of the committee members is required for passing. In the event of failure, the committee may determine whether another examination may be taken. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Titles

Dual-title M.S. and Ph.D. in Agricultural and Environmental Plant Science and International Agriculture and Development

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Graduate students with research and educational interests in international agriculture may apply to the dual-title degree program in Agricultural and Environmental Plant Sciences and International Agriculture and Development. The goal of the dual-title degree is to enable graduate students from Agricultural and Environmental Plant Sciences to acquire the knowledge and skills of their primary area of specialization, while at the same time gaining the perspective and methods needed for work in the international agriculture. Graduate study in this program seeks to prepare students to assume leadership roles in science, engineering, outreach, and project management anywhere in the world. Students acquire a broad perspective on how to apply their research findings in the context of the broader international community. Thus, the dual-title will allow students to master their field of specialization from an international perspective so that they can effectively engage in agricultural development activities within various countries and regions.

Admission Requirements

Students must apply and be admitted to the graduate program in AEPS and the Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the INTAD dual-title program. Refer to the Admission Requirements tab on the INTAD Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/international-agriculture-development/>). Doctoral students must be admitted into the dual-title degree program in INTAD prior to taking the qualifying examination in their primary graduate program.

Degree Requirements for the Dual-Title M.S.

To qualify for the dual-title degree, students must satisfy the degree requirements for the M.S. degree in AEPS, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual-title in INTAD, listed on the INTAD (<http://bulletins.psu.edu/graduate/programs/W/GRAD%20WMNST/>) Bulletin page. (<http://bulletins.psu.edu/graduate/programs/W/GRAD%20WMNST/>) Up to 6 credits of INTAD approved courses can be applied to fulfilling AEPS program requirements. Final course selection must be approved by the student's advisory committee.

Degree Requirements for the Dual-Title Ph.D.

To qualify for the dual-title degree, students must satisfy the degree requirements for the Ph.D. degree, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for

the dual-title Ph.D. in INTAD, listed on the INTAD Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/international-agriculture-development/>). Up to 6 credits of INTAD approved courses can be applied to fulfilling AEPS program requirements. Final course selection must be approved by the student's advisory committee.

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from AEPS and must include at least one Graduate Faculty member from the INTAD program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both AEPS and INTAD. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of an AEPS and INTAD dual-title Ph.D. student must include at least one member of the INTAD Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may service in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in INTAD, the member of the committee representing INTAD must be appointed as co-chair. The INTAD representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in AEPS and INTAD. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>)

section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Agricultural and Environmental Plant Science (AEPS) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/aeps/>)

Agronomy (AGRO) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/agro/>)

Horticulture (HORT) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/hort/>)

Learning Outcomes

M.S. and Ph.D. students in Agricultural and Environmental Plant Science will demonstrate competency and breadth of knowledge in their chosen specialization within plant science-related disciplines (Penn State goal #1). They will create new knowledge by conducting and reporting relevant research within their sub-disciplines (Penn State goal #2). Students will be able to communicate with diverse audiences regarding issues related to crops and their social and environmental impacts (Penn State goal #3). They will develop analytical and critical thinking skills so that they can apply their knowledge to agriculturally and environmentally relevant problems (Penn State goal #4). They will become practiced in applying the principles of academic integrity and proper research methodology and reporting (Penn State goal #5).

Contact

Campus	University Park
Graduate Program Head	Erin L Connolly
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Surinder Chopra
Program Contact	Stephanie L Hill slf5335@psu.edu (814) 863-7724

American Studies

Graduate Program Head	Jeffrey P. Beck
Program Code	AMSTD
Campus(es)	Harrisburg (Ph.D., M.A.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Arts (M.A.) Integrated B.A. in American Studies and M.A. in American Studies
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=AMSTD)

Master of Arts (M.A.)

The Master of Arts program in American Studies at Penn State Harrisburg offers an interdisciplinary approach to studying American society and culture. Through coursework and hands-on experiences, students gain valuable knowledge and analytical skills that prepare them for diverse roles in education, government, museums, cultural organizations, and communications.

With our flexible study options, including full- or part-time enrollment and evening courses, students can tailor their academic journey to suit their needs. Students also have the option to earn a certificate in heritage and museum practice or folklore and ethnography alongside their master's degree.

Doctor of Philosophy (Ph.D.)

The Ph.D. program in American Studies offers an interdisciplinary approach to studying American society and culture. Through coursework and hands-on experiences, students gain the knowledge and analytical skills needed for diverse careers both within and outside academia.

Our program offers a wide range of areas for coursework and research, including history, politics, cultural studies, literature, popular culture, folklore and ethnography, visual and material culture, regional and urban studies, and public history and museum studies. These areas intersect with important historical and contemporary issues such as race, gender and sexuality, ethnicity, and class, which are key components of our program.

Our faculty members are active researchers who support and encourage students to present their work at regional, national, and international venues. Located near renowned heritage sites and vibrant cities like Philadelphia and Washington, D.C., our program offers ample research opportunities, internships, and field trips.

Our graduate students become part of a rich interdisciplinary community of American scholars. Our program offers the benefits of small academic seminars, financial support, faculty mentorship, professionalization seminars, support for conference participation, and diverse research, internship, and employment opportunities.

We understand the needs of our students, and that's why we offer flexible scheduling, allowing many to pursue their degree while working full or part time. Most core graduate courses are held in the evening to accommodate busy schedules.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Master of Arts (M.A.)

The M.A. degree program in American Studies accepts students from a wide array of disciplines—particularly art, history, English, sociology, and anthropology—but recommends educational preparation related to the interdisciplinary study of American culture. An applicant must hold either (1) a baccalaureate degree from a regionally accredited U.S. institution or (2) a tertiary (postsecondary) degree that is deemed comparable to a four-year bachelor's degree from a regionally accredited U.S. institution.

This degree must be from an officially recognized degree-granting institution in the country in which it operates. All applicants must submit:

- a completed Graduate School online application form (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) with the application fee
- official transcripts from all post-secondary institutions attended (<http://gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>) (minimum of 2.75 junior/senior grade-point average on a 4.00 scale)
- two letters of recommendation from individuals who can attest to the student's ability to handle graduate study
- a statement of intent (approximately 500 to 1,000 words outlining their preparation for study, proposed fields of study, and career goals)
- and a sample of written work (seminar paper or equivalent research paper) as evidence of their American research and writing skills.

Students applying for scholarships and assistantships are requested to submit general examination scores of the Graduate Record Examination (GRE) taken within five years previous to the date of application. The GRE is recommended, but not required, for admission. Applications for the M.A. are accepted on a rolling basis. To be considered for scholarships and graduate assistantships for full-time study beginning in the fall, the completed application and current GRE scores must be received by Feb. 15.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Doctor of Philosophy (Ph.D.)

Applicants for the Doctor of Philosophy in American Studies must hold a master's degree in American Studies, or a related field emphasizing American cultural scholarship and public heritage work such as:

- History
- English
- Sociology
- Political Science
- Folklore
- Cultural Studies
- Performance Studies
- Ethnic Studies
- Gender Studies
- Communications
- Art History
- Museum and Library Studies
- Education
- Cultural Resource Management

Students are required to submit the following:

- a completed Graduate School online application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) with the application fee;

- official transcripts from all post-secondary institutions attended (<http://gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>);
- three letters of reference attesting to both academic and professional capabilities. (At least two of these letters should be from academic sources, such as professors or academic advisers);
- a letter of 500 to 1000 words outlining significant scholarly and applied experience, career goals, commitment to American Studies as a field, and academic objectives;
- a recent personal curriculum vitae;
- a paper from a graduate course taken previously or publication demonstrating research and composition skills.

Students applying for scholarships and assistantships are requested to submit general examination scores of the Graduate Record Examination (GRE) taken within five years previous to the date of application. The GRE is recommended, but not required, for admission.

Admission is highly competitive and the best-qualified students will be admitted subject to space availability and compatibility of the student with the program’s research mission. Successful applicants with an M.A. typically have a GPA of 3.5 or above (on a 4.0 scale) in their graduate work.

International applicants must hold the equivalent of an American master’s degree. They must submit official or attested university records, with certified translations if the records are not in English. Notarized copies are not sufficient.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of ARTs (M.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The student is required to take a minimum of 30 (non-thesis) - 33 (thesis) credits in American Studies, including at least 18 credits in the 500 series.

Code	Title	Credits
Required Courses		
AMST 500	Theory and Methods ¹	3
AMST 591	Seminar in American Studies ²	3
Culminating Experience		
AMST 580 or AMST 600	Projects in American Studies ³ Thesis in American Studies	1-6

¹ AMST 500 should be taken within the first two semesters of study.

² AMST 591 should be taken in the last two semesters of study.

³ Usually in the last semester of study, students are required to complete their program with a major paper by taking AMST 580 or thesis, in which case AMST 600 is taken. The choice of AMST 580 to fulfill graduation requirements is for an original scholarly master’s paper

or project. One to 6 credits in AMST 580 can be earned; the typical number of credits for the culminating project is 3. The choice of AMST 600 is for a thesis and is taken for 6 credits. The thesis must follow the Submission Requirements (<http://gradschool.psu.edu/current-students/etd/>) of the Office of Theses and Dissertations in the Graduate School.

Advanced undergraduate courses (400-level) that have not counted toward a student’s undergraduate degree may be considered for transfer into the graduate student’s requirement of 30 credits of American Studies with permission of the program, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>). At least 20 of the 30 credits must be earned at the Harrisburg location where the program is offered. Courses not having an American Studies designation but which are relevant to American Studies may be considered for inclusion in the student’s requirement of 30 credits of American Studies with permission of the program.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Over some twelve-month period during the interval between admission to the Ph.D. program and completion of the Ph.D. program, the student must spend at least two semesters (summer sessions are not included) as a registered full-time student (9 credits per semester) engaged in academic work at Penn State Harrisburg. A doctoral student is required to complete the program, including defense and acceptance of the doctoral dissertation, within eight years after successful completion of the qualifying examination.

Students progress through the following phases and take courses designated by their Ph.D. committee as part of their study for the Ph.D.

In the initial phase, the student must:

1. make up any deficiencies in graduate courses in American Studies noted in the letter of acceptance
2. complete with a grade of B or better the following courses: AMST 500, two sections of AMST 502 on different topics, and AMST 591
3. pass a qualifying examination

Admitted students who have met all course prerequisites begin the core courses with AMST 500. Students who have already taken AMST 500 within three years of admission may begin their program of study with AMST 502.

The qualifying examination is administered by a special committee appointed by the director of the doctoral program.

The comprehensive examination is taken after course work in subfields is completed. The written examination consists of three parts and is administered by the student’s Ph.D. committee. One is in the area of Theory and Method and an additional two subfields of study from a list of five areas covered in the program. The five subfields of specialization are:

1. Public Heritage, Cultural Resource Management, and Museum Studies;
2. Folk and Popular Culture (material and visual culture, literature and media, language, performance, media, and music);

3. Interdisciplinary History and Politics (history of ideas, philosophy, and politics; biography and oral history; everyday life and socioeconomic studies; government, public policy, and diplomacy);
4. Society and Ethnography (race, ethnicity, class, gender, age; religion and belief; comparative culture and transnationalism);
5. Regional, Environmental, Urban, and Local Studies.

Additional subfields of study within American Studies may be selected with the approval of the student's Ph.D. committee. An oral defense of the comprehensive examination is scheduled after the written examination, at which time it is customary for the candidate to present the dissertation proposal.

Although the exact number of courses required in each subfield may vary among students, typically four per subfield are required. Ph.D. committees meet with students at least once each academic year. Written and oral comprehensive examinations in the three areas are given at the end of the study period.

Under guidance from the Ph.D. committee, the candidate prepares a detailed research proposal that serves as the basis for the written dissertation covering an aspect of American Studies. The dissertation should represent a significant contribution to knowledge, show familiarity with the intellectual heritage of American Studies, be presented in a scholarly manner, reveal an ability on the part of the candidate to do independent research of high quality, and indicate considerable experience in using a variety of research techniques and forms of primary evidence. The contents and conclusions of the dissertation must be defended at the time of the final oral examination. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School, and the student must pass the final oral examination (the dissertation defense).

Integrated Undergrad-Grad Programs

Integrated B.A. in American Studies and M.A. in American Studies

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.A. in American Studies with the M.A. in American Studies offered at the following campuses:

Undergraduate Degree

- Abington
- Brandywine
- Harrisburg

Graduate Degree

- Harrisburg

The graduate portion of this IUG is currently offered as face-to-face residential instruction. While the undergraduate curriculum for this IUG may be completed at multiple campuses, the ease and feasibility of completing the integrated program may be heavily dependent upon the location of the graduate instruction. Please discuss the feasibility of completing the IUG with a representative for the graduate program before beginning the application process.

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/>

[gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/](https://gradschool.psu.edu/graduate-education-policies/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/)).

The American Studies program offers an integrated B.A./M.A. program that is designed to allow academically superior baccalaureate students enrolled in the American Studies major to obtain both the B.A. and the M.A. degrees in American Studies within five years of study. The first two years of undergraduate coursework typically include the University General Education requirements and lower-level courses. In the third year, students typically take upper-division coursework in American Studies and define areas of interest. The fourth year involves graduate-level American Studies coursework including required courses in AMST 500. The fifth and final year of the program typically consists of graduate coursework in American Studies including AMST 591 and identification of a research project that will culminate in the completion of a M.A. project (AMST 580) or thesis (AMST 600).

By encouraging greater depth and focus in the course of study beginning in the third undergraduate year, this program will help the student more clearly define his/her area of interest and expertise in the broad field of American Studies. As a result, long-range academic planning for exceptional students pursuing doctoral degrees or other professional goals after leaving Penn State will be greatly enhanced. For most students, the total time required to reach completion of the higher degree will be shortened by about a year. The student will have earlier contact with the rigors of graduate study and with Graduate Faculty. The resources of the Graduate School are accessible to students accepted into the IUG program. Students in their third and fourth year of study with IUG status benefit from their association with graduate students whose level of work parallel their own.

If for any reason a student admitted to the B.A./M.A. program is unable to complete the requirements for the Master of Arts degree program in American Studies, the student will be permitted to receive the B.A. degree assuming all degree requirements have been satisfactorily completed.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The number of openings in the integrated B.A./M.A. program is limited. Admission will be selective based on specific criteria and the unqualified recommendation of faculty. Applicants to the integrated program:

1. Must be enrolled in the American Studies B.A. program and meet the admission requirements of the American Studies M.A. program.
2. Must apply and be admitted to the Graduate School.
3. Must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.
4. Must have completed at least one 400-level American Studies course (AMST prefix) with a grade of A.
5. Must submit transcript(s) of previous undergraduate work, recommendations from two faculty members, writing sample, and statement of goals.

6. Must have an overall GPA at or above 3.3 (on a 4.0 scale) in undergraduate coursework and a GPA at or above 3.5 in all coursework completed for the American Studies major.
7. Must present a plan of study approved by the student's adviser in the application process.

Degree Requirements

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
AMST 491W	American Studies Perspectives (two seminars on different topics taken during the student's fourth (senior) year)	6
AMST 500	Theory and Methods (taken during the student's fourth (senior) year)	3
AMST 591	Seminar in American Studies (taken during the student's fifth year)	3

With the approval of the student's adviser, students may take American Studies courses from the 100 to 400 levels at Penn State campuses other than Harrisburg, but 500-level courses must be taken at the Harrisburg campus.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

American Studies (AMST) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/amst/>)

Learning Outcomes

Master of Arts (M.A.)

1. Graduates will demonstrate knowledge of the history, society, culture, and arts of the United States by conducting research in accordance with the highest ethical and professional standards and, with a variety of evidence, including objects, still and moving images, practices and performances, and oral and written texts.
2. Graduates will demonstrate knowledge of American Studies historiography by identifying major movements and approaches in the study of the American experience and providing major scholarly bibliographic and cultural sources for those movements and approaches.
3. Graduates will apply presentational and communicative skills used in American Studies scholarship, including oral presentation, writing, and exhibition, to produce material that can be used in educational institutions, heritage and museum organizations, and governmental and cultural agencies.
4. Graduates will demonstrate analytical skills such as symbolic analysis, cross-cultural comparison, and ethnographic fieldwork, to interpret meaning in historical, social, cultural, and artistic trends and movements in the United States.

Doctor of Philosophy (Ph.D.)

1. Graduates will demonstrate knowledge of the history, society, culture, and arts of the United States by conducting research in accordance with the highest ethical and professional standards and, with a variety of evidence, including objects, still and moving images, practices and performances, and oral and written texts.
2. Graduates will demonstrate knowledge of American Studies historiography by identifying major movements and approaches in the study of the American experience and providing major scholarly bibliographic and cultural sources for those movements and approaches.
3. Graduates will apply presentational and communicative skills used in American Studies scholarship, including oral presentation, writing, and exhibition, to produce material that can be used in educational institutions, heritage and museum organizations, and governmental and cultural agencies.

4. Graduates will demonstrate analytical skills such as symbolic analysis, cross-cultural comparison, and ethnographic fieldwork, to interpret meaning in historical, social, cultural, and artistic trends and movements in the United States.

Contact

Campus	Harrisburg
Graduate Program Head	Jeffrey P Beck
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Anthony Bak Buccitelli
Program Contact	Amber Reichwein Penn State Harrisburg 777 W. Harrisburg Pike Middletown PA 17057 anr244@psu.edu (717) 948-6201
Program Website	View (https://harrisburg.psu.edu/humanities/american-studies/master-arts-american-studies/)

Anatomy

Graduate Program Head	Patricia J. McLaughlin
Program Code	ANAT
Campus(es)	Hershey (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Dual-Title Ph.D. in Anatomy and Clinical and Translational Sciences
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=ANAT)

The Anatomy graduate program provides students curricular training with a unique focus on human anatomy, health and disease, and the opportunity for concentrated research in a related discipline such as:

- Biochemistry
- Cancer biology
- Cell biology
- Embryology
- Genetics
- Immunology
- Neuroscience
- Pharmacology
- Physiology
- Structural biology
- Virology

Students receive rigorous training that provides the skills and scholarship necessary to be educators in human anatomy and leaders in biomedical research. This program also provides training for other endeavors that benefit from a rigorous scientific background, including education, law, journalism, and public policy. A dual-title degree in Anatomy and Clinical and Translational Sciences expands the educational experience of students training in anatomical science to include training, via a unique curriculum and research focus, for career paths that involve clinical trials or clinical research programs.

The Anatomy graduate program is an interdepartmental program that engages faculty from 4 basic science and clinical science departments throughout Penn State University on multiple campuses. This broad-reaching program provides students a wide ranging understanding of multiple disciplines with specific expertise in a chosen area, and encourages interdisciplinary research that is the hallmark of biomedical sciences in the 21st century.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

1. Completed official Penn State Graduate School Application for Admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>); Master's or Doctoral Degree
2. Three letters of recommendation
3. Statement of goals including
 - a. your reasons for applying to the Anatomy graduate program
 - b. particular areas of research interests if known, and
 - c. long-term career goals
4. Post-secondary course work must include biochemistry and molecular biology or genetics.

Degree Requirements

Master of science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The Anatomy program actively recruits students to earn the academic degree of Master of Science. To receive the M.S. degree in Anatomy, at least 30 credits are required (400-, 500-, 600-, or 700-level) with a minimum of 18 credits from courses at the 500 and 600 level courses combined. The first-year fall curriculum provides 12 credits of the necessary core material that encompasses human gross anatomy, human embryology, and human microscopic anatomy (histology) for the anatomy degree. In addition, the Fall curriculum includes a one-credit colloquium which introduces the student to professionalism, scientific communication, and addresses manuscript evaluation and writing, as well as scientific methodology and techniques that will be discussed in subsequent coursework. The professionalism elements reinforce ethics courses but focus on regulatory issues of animal or patient use and research.

Code	Title	Credits
Required Courses		
ANAT 503	Gross Anatomy	6
ANAT 512	Human Embryology and Teratology	2
ANAT 505	Histology and Embryology I	2
ANAT 506	Histology and Embryology II	2
ANAT 590	Colloquium (1 credit assigned an "R" grade)	1
1 semester of a Biomedical Ethics course		1
Electives		
Elective Course Work ¹		10
Culminating Experience		

ANAT 600	Thesis Research	6
Total Credits		30

¹ NEURO 511 is highly recommended as an elective, but is optional.

Students must complete original laboratory research that culminates in a thesis. The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School, and the student must pass a thesis defense.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The first-year Fall curriculum provides 12 credits of the necessary core material that encompasses human gross anatomy, human embryology, and human microscopic anatomy (histology) for the anatomy degree. In addition, the Fall curriculum includes a one-credit colloquium which introduces the student to professionalism, scientific communication, and addresses manuscript evaluation and writing, as well as scientific methodology and techniques that will be discussed in subsequent coursework. The professionalism elements reinforce ethics courses but focus on regulatory issues of animal or patient use and research. The first-year Spring curriculum includes one 3-credit course focusing on neuroanatomical studies.

In addition, during the first year, students complete three research rotations that expose them to the wide range of research interests of The Pennsylvania State University Graduate Faculty from both basic and clinical science departments at the College of Medicine in Hershey. These rotations serve to inform the students with regard to choosing a thesis or dissertation adviser and forming a Ph.D. committee. In addition students are advised to take ethics, statistics and electives. The doctoral students also complete their Qualifying Examination which involves an oral presentation and a written examination on anatomical coursework. In the Fall of the second year, the students register for 2 credits of Supervised Teaching that allows them to have a full complement of experiences in lecturing, dissecting, preparation of exams, and tutoring students. In addition, the requirements involve a 6-credit BMS course on Biomedical Sciences that encompasses didactic and interactive course work on principles of basic molecular and cellular principles of biomedical science.

In addition, each student must complete research rotations, as well as elective courses that may include statistics or other electives. Each student for the Ph.D. degree must fulfill written and spoken English communication requirements that are satisfied by preparing written and oral reports describing the laboratory rotations during the first year.

Code	Title	Credits
Required Courses		
<i>Fall Semester</i>		
ANAT 503	Gross Anatomy	6
ANAT 505	Histology and Embryology I	2
ANAT 506	Histology and Embryology II	2
ANAT 512	Human Embryology and Teratology	2
ANAT 590	Colloquium (1 credit assigned an "R" grade)	1
<i>Spring Semester</i>		
NEURO 511	Neurobiology II	3

PHS 500	Research Ethics for Clinical Investigators	1
ANAT 596	Individual Studies	1-3
<i>Second Year</i>		
BMS 501	Regulation of Cellular & Systemic Energy Metabolism	3
BMS 502	Cell and Systems Biology	3
ANAT 602	Supervised Experience in College Teaching	2-3
Electives		
Elective courses (including statistics and ethics if not otherwise completed) that are selected in consultation with the student's dissertation adviser and Ph.D. committee		
Total Credits		26-29

At the end of the first year, continuation in the program is determined by performance in course work, laboratory rotations, and the ANAT graduate program Qualifying Examination. Students join their research laboratory by July 31 of the first year.

The Ph.D. committee is formed upon entry into the dissertation laboratory, and must comply with the Graduate Council Ph.D. committee requirements (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>). The committee must include three Anatomy graduate program faculty, with at least two faculty members in the major field.

Ph.D. students must pass a written Comprehensive Examination in the format of a grant application prior to the end of the fifth semester of enrollment. As part of this examination, the student also gives an oral presentation of this proposal to the candidate's Ph.D. committee.

It is expected that the Ph.D. candidate will have at least one paper submitted for publication in a major peer-reviewed scientific journal prior to the final oral examination (the dissertation defense). The dissertation must be prepared and defended by each Ph.D. candidate. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Titles

Dual-Title Ph.D. in Anatomy and Clinical and Translational Sciences

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Potential dual-title trainees will express an interest in the dual-title degree as early as during the recruitment process for the Anatomy Graduate Program, and may apply for the dual-title Ph.D. in Anatomy and Clinical and Translational Sciences following admission to the Graduate School and to the Anatomy program and prior to taking the qualifying examination in Anatomy, no later than the end of the third semester of graduate study in Anatomy. Students interested in the dual-title degree will be considered for admission to the Clinical and Translational Sciences program by a committee consisting of the Clinical and Translational Sciences program co-directors and faculty affiliated with the Clinical and Translational Sciences dual-title program. Refer to the Admission Requirements section of the CTS Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/clinical-translational-sciences/>).

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the Ph.D. degree, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual-title Ph.D. in CTS, listed on the CTS Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/clinical-translational-sciences/>). Reciprocity between the CTS dual-title program and the Anatomy graduate program allows for up to 7 of the elective credits required for the Clinical and Translational Sciences degree to be met simultaneously (ethics, statistics, and 1 elective).

Anatomy graduate students accepted to the Clinical and Translational Sciences dual-Title program will take the qualifying examination at the end of the third semester of graduate training:

1. to allow exposure to the Clinical and Translational Sciences curriculum in the Spring semester of the first year and Fall semester of the second year, which will prepare the students for the integrated content of the dual-title qualifying exam, and
2. to allow sufficient time to identify and assure commitment of an appropriate dissertation adviser who embraces the dual-title program of the student.

During the qualifying examination, the student will also be assessed for the dual-title program, and at least one member of the qualifying examination committee must come from the dual-title program. Faculty members who hold appointments in both programs may serve in a combined role.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of an Anatomy and Clinical and Translational Sciences dual-title doctoral degree student must include at least one member of the Clinical and Translational Sciences Graduate Faculty. Faculty members who hold appointments in both programs' graduate faculty may serve in a combined role.

The committee chair will be a member of the Graduate Faculty in the primary graduate program. Faculty members who hold appointments in both the primary graduate program and the CTS program may serve in a combined role. If the committee chair does not serve in this combined role, the faculty member representing the CTS program must be designated co-chair of the committee. The CTS representative(s) will be expected to assist in constructing and evaluating comprehensive examination questions that cover the secondary area of study.

Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. Students enrolled in the dual-title program are required to write and orally defend a dissertation on a topic that reflects their original research and expertise in both Anatomy and Clinical and Translational Sciences. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

graduate-education-policies/), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Anatomy (ANAT) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/anat/>)

Learning Outcomes

Master of Science (M.S.)

1. **KNOW:** Anatomy master's degree graduates will demonstrate a) a broad base of knowledge in the anatomical sciences including human gross anatomy, human microscopic anatomy (histology), and human development, b) a broad base of biological knowledge required to understand the molecular, cellular, and organismal processes related to biomedical sciences; c) a broad understanding of experimental approaches used to investigate biomedical problems; d) in-depth knowledge within their specific areas of research interests, and e) the highest standards of research ethics.
2. **CREATE:** Anatomy master's degree graduates will creatively synthesize theory and literature to generate questions, ideas, or hypotheses addressing current problems in human health and disease, and will devise critical experimental approaches to test these ideas and hypotheses.
3. **APPLY:** Anatomy master's degree graduates will perform hypothesis-driven, original research that addresses current problems in biomedical sciences - often related to their mentor's primary research.
4. **COMMUNICATE:** Anatomy master's degree graduates will perform independent and original research studies that address current

problems in biomedical sciences leading to rigorous and reproducible experimental outcomes.

5. **CRITICAL THINKING:** Anatomy master's degree graduates will critically evaluate experimental approaches and results of their own research and the research of others.
6. **PRACTICE:** Anatomy master's degree graduates will conduct all activities in research practices and interactions with medical professionals with the highest level of ethics and integrity.
7. **APPLY:** Anatomy master's degree graduates will capitalize on their knowledge and research skills to obtain placement in professional schools, to continue their education in alternative careers, and/or to obtain careers in biomedical research or anatomical teaching.

Doctor of Philosophy (Ph.D.)

1. **Know:** Anatomy graduates will demonstrate a) a broad base of knowledge in the anatomical sciences including human gross anatomy, human microscopic anatomy (histology), and human development, b) a broad base of biological knowledge required to understand the molecular, cellular, and organismal processes related to biomedical sciences; c) a broad understanding of experimental approaches used to investigate biomedical problems; d) in-depth knowledge within their specific areas of research interests, and e) the highest standards of research ethics.
2. **Create:** Anatomy graduates will synthesize material in the anatomical sciences to formulate didactic lectures, flipped-classrooms, problem-based learning modules, and team-based learning. Students will creatively organize material for classroom and laboratory (cadaver dissections) presentations. Graduates will creatively synthesize theory and literature to generate questions, ideas, or hypotheses addressing current problems in human health and disease, and will devise critical experimental approaches to test these ideas and hypotheses.
3. **Apply:** Anatomy graduates will demonstrate their anatomical knowledge by providing lectures to first and second year medical students and physician assistant students, as well as upper-class medical students and residents. Graduates will be involved in hands-on training of medical and PA students in cadaver-based laboratory settings including (i) assisting in preparation of laboratory and written examinations, (ii) identification of structures for laboratory practical exams, and (iii) preparing and grading written exams. Graduates will perform independent and original research studies that address current problems in biomedical sciences leading to rigorous and reproducible experimental outcomes.
4. **Critical thinking:** Anatomy graduates will be required to interpret a large body of knowledge and condense material to provide important components to medical and physician assistant students. In terms of research, graduates will critically evaluate experimental approaches and results of their own research and the research of others.
5. **Communicate:** Anatomy graduates will convey knowledge on the subjects of human gross anatomy, embryology and microscopic anatomy (histology) and neuroanatomy to a variety of audiences including undergraduate students (Brain Bee), medical students, physician assistant students, as well as to graduate medical students in residency programs at Penn State Hershey. In terms of research activities, graduates will convey ideas, experimental approaches, and results in clear, concise, well-organized papers, posters, proposals, oral presentations, and discussions.
6. **Professional practice:** Anatomy graduates will begin interactions with other professionals within 2 years of matriculation, as they are included in teams of faculty involved in medical education

oversight and curriculum design and review. In terms of research, graduates will collaborate in a collegial and ethical manner with other professionals within their field or with diverse scientific backgrounds.

7. **Career development:** Anatomy graduates will pursue academic teaching positions at undergraduate school, graduate schools with allied health science centers, and professional medical universities with programs in a variety of medical health fields. Graduates will participate in, and attend, professional career seminars at the College of Medicine, Career Day activities, and maintain a yearly IDP (individual development plan). In many cases for university employment, both teaching and research expertise are required.

Contact

Campus	Hershey Med Ctr
Graduate Program Head	Pat McLaughlin
Program Contact	Kristin E Smith College of Medicine, H170 500 University Drive Hershey PA 17033 kec17@psu.edu (717) 531-1045
Program Website	View (http://med.psu.edu/anatomy-phd/)

Ancient Mediterranean Studies

Graduate Program Head	Tawny Holm
Program Code	AMS
Campus(es)	University Park
Degrees Conferred	Master of Arts (M.A.)

The M.A. program in Ancient Mediterranean Studies M.A. is a broad, interdisciplinary program focused on the cultures, literatures, and histories of the ancient Mediterranean world. Students combine course work on research methodologies with seminars in their own areas of interest. Possible areas of interest could include—but are not limited to—the Ancient Near East, Egypt, the Hebrew Bible, early Judaism, Greece, Rome, Early Christianity, and the modern reception of the ancient Mediterranean world. The M.A. is a general humanistic degree that aims to prepare students for a variety of professions, including, but not limited to, future graduate work, secondary teaching, library science, and museum work.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Undergraduate preparation in Ancient Mediterranean Studies or one of its sub-fields (e.g., Classics, Ancient Near Eastern Studies, Hebrew Bible, Egyptology, Early Christianity) is advisable. Students with a 3.00 junior/senior grade-point average (on a 4.00 scale) and with appropriate course backgrounds will be considered for admission. Exceptions to this minimum GPA may be made for students with special backgrounds, abilities, and interests at the discretion of the program.

Degree Requirements

Master of Arts (M.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A minimum of 30 credits at the 400 or 500 level, with at least 18 credits at the 500 level. There are 6 credits in the following core courses: CAMS 550 and CAMS 560. In addition, 18 credits are required in CAMS, GK, LATIN, HEBREW and other courses in related subject matter. Relevant courses will be chosen in consultation with the student's adviser. The culminating experience for the degree is a satisfactory master's paper completed while the student is enrolled in CAMS 596.

Code	Title	Credits
Required Courses		
CAMS 550	Proseminar	3
CAMS 560	Research Seminar	3
Electives		
18 credits in CAMS, GK, LATIN, HEBREW and other courses in related subject matter selected in consultation with the student's adviser.		18
Culminating Experience		
CAMS 596	Individual Studies (Master's Paper)	6
Total Credits		30

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

- KNOW:** Demonstrate breadth and knowledge of one or more subfields involved in the study of the Ancient Mediterranean world (e.g., Classics, Ancient Near East, Egypt, Hebrew Bible, Early Christianity) and be able to critically evaluate, integrate, and apply that knowledge.
- APPLY/CREATE:** Acquire proficiency in conducting research, including formulating research questions, designing methodologies, and effectively utilizing academic resources to contribute to the scholarly discourse in the field.
- COMMUNICATE:** Communicate the major issues involved in the study of the ancient Mediterranean world at all levels of expertise.
- THINK:** Develop advanced critical thinking skills to evaluate and interpret primary and secondary sources, including texts, artifacts, archaeological evidence, and visual materials.
- PROFESSIONAL PRACTICE:** Know and conduct themselves in accordance with the highest ethical standards and values.

Contact

Campus	University Park
Graduate Program Head	Tawny Lee Holm
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Anna Irene Peterson
Program Contact	Kristi L Brinker klb776@psu.edu (814) 863-6433

Animal Science

Graduate Program Head	Adele M. Turzillo
Program Code	ANSC
Campus(es)	University Park (Ph.D., M.S., M.P.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Master of Professional Studies (M.P.S.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=ANSC)

Animal Science may be defined as the study and integration of all disciplines that relate to the function and care of animals for the benefit of society by providing companionship, food, fiber, performance, and research. Graduate students may specialize in animal management, breeding, genetics and genomics, growth and developmental biology, meat science, nutrition, reproductive biology, and animal health. The department maintains numerous facilities for research involving both small and large animals. Laboratories are equipped with the latest instrumentation. Herds of dairy and beef cattle, sheep, swine, white tail

deer, horses, as well as flocks of poultry, including chickens, turkeys, and quail, are maintained for instruction and research.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Prerequisite to graduate work is the completion of an undergraduate major in animal science, dairy science, poultry science, or a related biological science.

Although not required, applicants are strongly encouraged to take the Graduate Record Examinations (GRE). Students with a 3.00 junior/senior grade-point average (on a 4.00 scale) and with appropriate course backgrounds will be considered for admission on a competitive basis.

Exceptions to admission requirements may be made for students with special backgrounds, abilities, and interests.

Degree Requirements

Master of Professional Studies (M.P.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

A minimum of 30 credits at the 400 or 500 level is required, with a minimum of 18 credits at the 500 level, and at least 6 credits in formal (i.e., non-core) courses in animal agriculture/biological science area at the 500 level. In addition, the following Program core courses (credits) are required:

Code	Title	Credits
Required Courses		
ANSC 500	Foundation Readings in Animal Science	1
ANSC 502	Scientific Scholarship (Ethics Offering)	2
ANSC 590	Colloquium	2
ANSC 602	Supervised Experience in College Teaching	1
Culminating Experience		
ANSC 596	Individual Studies (Scholarly Paper)	3

A maximum of 10 credits may be earned in special problem-type courses, which may include up to 3 credits in ANSC 596 for the scholarly paper. The culminating experience for the degree is a scholarly paper completed while the student is enrolled in ANSC 596.

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The academic M.S. program requires a thesis and is designed for those primarily interested in education and research. A minimum of 30 credits at the 400, 500, or 600 level is required, with a minimum of 18 credits at the 500 or 600 level, and at least 12 credits in formal (i.e., non-core) courses in animal agriculture/biological science area with at least 6 of the 12 credits at the 500 level. Students are required to write a thesis, and at least 6 credits in thesis research (ANSC 600 or ANSC 610) must be

taken in conjunction with completing the thesis. In addition, the following Program core courses (credits) are required:

Code	Title	Credits
Required Courses		
ANSC 500	Foundation Readings in Animal Science	1
ANSC 502	Scientific Scholarship (Ethics Offering)	2
ANSC 590	Colloquium	2
ANSC 602	Supervised Experience in College Teaching	1
Culminating Experience		
ANSC 600	Thesis Research	6
or ANSC 610	Thesis Research Off Campus	

The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School, and the student must pass a thesis defense.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The academic Ph.D. program requires a dissertation and is designed for those primarily interested in education and research. Official entrance into the Ph.D. program occurs upon successful completion of the qualifying examination. Ph.D. degree requirements include successful completion of the following: approved graduate course work, English Competence requirements, a comprehensive examination, and a final oral examination (the dissertation defense). To earn the Ph.D. degree, doctoral candidates must write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School. In addition, the following Program core courses (credits) are required:

Code	Title	Credits
Required Courses		
ANSC 500	Foundation Readings in Animal Science	2
ANSC 502	Scientific Scholarship (both the Ethics offering and the Grantsmanship offering)	4
ANSC 590	Colloquium ¹	3
ANSC 602	Supervised Experience in College Teaching	1

¹ Students who completed 2 credits of ANSC 590 as part of an M.S. degree program in Animal Science must take 1 additional credit of ANSC 590 during their Ph.D. program. For students entering the Ph.D. program with an M.S. degree from another institution, one credit of ANSC 590 will be waived; therefore, they will be required to complete 2 credits of ANSC 590 during their Ph.D. program.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Animal Science (ANSC) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/ansc/>)

Learning outcomes

Master of Science (M.S.)

1. **KNOW.** Students will demonstrate appropriate breadth and depth of disciplinary knowledge (e.g., nutrition, physiology, statistics, etc.), a command of the current literature relating to their thesis project, and a thorough understanding of the problems that their research addresses.
2. **APPLY/CREATE.** Students will apply current knowledge in their field to design animal studies and/or perform laboratory methods or other techniques to address their research problems, while generating and testing new ideas or hypotheses that provide solutions to those problems.
3. **COMMUNICATE.** Students will effectively communicate their research findings, both in writing, via abstracts and manuscripts, and orally, via seminars and oral or poster presentations, to peers, advisors/mentors, and other scholars and/or stakeholders in their specialty field or beyond their discipline.
4. **THINK.** Students will be able to conceptualize and critically evaluate the work of others in their field.
5. **PROFESSIONAL PRACTICE.** Students will be able to identify ethical issues in research, will become familiar with University policies involving the use of animals and human subjects in research, will act ethically and exhibit collegiality with other professionals within or

outside of their field, and will engage in service to the profession and to society.

Doctor of Philosophy (Ph.D.)

1. **KNOW.** Students will demonstrate appropriate breadth and depth of disciplinary knowledge (e.g., nutrition, physiology, statistics, etc.), a command of the current literature relating to their thesis project, and a thorough understanding of the problems that their research addresses.
2. **APPLY/CREATE.** Students will apply current knowledge in their field to design animal studies and/or perform laboratory methods or other techniques to address their research problems, while generating and testing new ideas or hypotheses that provide solutions to those problems.
3. **COMMUNICATE.** Students will effectively communicate their research findings, both in writing, via abstracts and manuscripts, and orally, via seminars and oral or poster presentations, to peers, advisors/mentors, and other scholars and/or stakeholders in their specialty field or beyond their discipline.
4. **THINK.** Students will be able to conceptualize and critically evaluate the work of others in their field.
5. **PROFESSIONAL PRACTICE.** Students will be able to identify ethical issues in research, will become familiar with University policies involving the use of animals and human subjects in research, will act ethically and exhibit collegiality with other professionals within or outside of their field, and will engage in service to the profession and to society.

Contact

Campus	University Park
Graduate Program Head	Adele Marie Turzillo
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Ramesh Ramachandran
Program Contact	Kacey J Burke 109 Animal, Veterinary and Biomedical Sciences Bldg. University Park PA 16802 kjlw217@psu.edu (814) 865-7638
Program Website	View (http://animalscience.psu.edu/graduateprograms/)

Anthropology

Graduate Program Head

Timothy Ryan

Program Code

ANTH

Campus(es)

University Park (Ph.D., M.A.)

Degrees Conferred

Doctor of Philosophy (Ph.D.)

Master of Arts (M.A.)

Dual-Title Ph.D. in Anthropology and Bioethics

Dual-Title Ph.D. in Anthropology and Climate Science

Dual-Title M.A. and Ph.D. in

Anthropology and Demography

Dual-Title Ph.D. in Anthropology and Microbiome Sciences

Dual-Title M.A. and Ph.D. in

Anthropology and Transdisciplinary

Research on Environment and

Society

Integrated B.S. in Anthropological Science and B.A. in Classics and Ancient Mediterranean Studies and

M.A. in Anthropology

Integrated B.A. in Anthropology

and B.A. in Classics and Ancient

Mediterranean Studies and M.A. in

Anthropology

Joint M.D. / Ph.D. with the College

of Medicine

The Graduate Faculty

View ([https://](https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=ANTH)

secure.gradsch.psu.edu/gpms/?searchType=fac&prog=ANTH)

The Department of Anthropology at Penn State integrates social, ecological, and evolutionary approaches to understand variability in the human condition through time and across space. We offer an integrated program of graduate study at both the Ph.D. and M.A. level focusing on specialized training in:

- human and behavioral ecology
- cultural anthropology
- anthropological demography
- archaeology
- archaeometry
- genetics
- human evolution
- the behavioral and evolutionary biology of human and non-human primates

Students also have the option of enrolling in dual-title Ph.D. graduate programs in Climate Science, Demography, Transdisciplinary Research on Environment and Society (TREES), and Bioethics, and dual-title M.A. programs in Demography and TREES. The Department also offers two Integrated Undergraduate/Graduate (IUG) programs (B.A./M.A. and B.S./B.A./M.A.): with the Department of Classics (CAMS). In addition, the Department of Anthropology also offers a joint M.D./Ph.D. degree program with the College of Medicine.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Entrance to the Anthropology graduate program occurs in the fall semester. Applications must be received by the department no later than December 1 for fall admission. The Department of Anthropology requires Ph.D. program applicants to submit:

- official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>)
- a statement of purpose
- a CV
- at least three letters of recommendation from persons familiar with the applicant's academic performance
- Graduate Record Examinations (GRE) scores (verbal, quantitative, and analytical) are OPTIONAL

A Master's degree is not required to apply to the Ph.D. Program. The department does not admit students to the terminal Master's degree, but does allow students to apply for a Master's degree through admission to the IUG (Integrated Undergraduate and Graduate) program and Ph.D. degree program.

Degree Requirements

Master of Arts (M.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A minimum of 30 credits at the 400, 500, 600, or 800 level is required, with least 18 credits at the 500 and 600 level, combined. 600 level credits are taken by students completing a thesis, students completing a scholarly paper must have at least 18 credits at the 500 level. All Master's students are required to take the following:

Code	Title	Credits
Required Courses		
<i>Core Theory Seminars</i>		
ANTH 560	Ecology, Evolution, and Human Behavior	3
ANTH 571	Principles of Human Evolutionary Biology	3
ANTH 588	Method and Theory in Archaeology	3
<i>Literature Review Seminar</i>		
ANTH 541	Current Literature in Integrative Anthropology	2
Culminating Experience		
ANTH 600	Thesis Research	
or ANTH 596	Individual Studies	

Students can choose to complete a thesis or a scholarly paper as the culminating experience for the degree. Students who choose to complete a thesis must take a minimum of 6 thesis research credits (ANTH 600). The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School. Students in

the non-thesis track must complete 18 credits at the 500 level, and must write a satisfactory scholarly paper, while enrolled in ANTH 596.

Additional course work is tailored to the student's research interests after advance consultation with their adviser, and specific courses may be required by the adviser depending on the student's background and research plans.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The doctoral degree in Anthropology requires a minimum of 30 credits, 27 of which are required coursework and 3 credits of which are electives. All first-year Ph.D. students are required to register for 9-12 credits per semester and complete 15 credits of course work, including the three core theory seminars (ANTH 560, ANTH 571, ANTH 588) and two research method seminars (ANTH 572, and ANTH 573). The core method and theory courses will serve as the basis for the Ph.D. qualifying exam, which will take place at the end of the first year.

In the fall of the second year, all students in the Ph.D. program should enroll for a total of 9-12 credits per semester, including ANTH 509. ANTH 508, Visualizing Anthropological Data, is required for all Ph.D. students and may be taken at any point in the first two years. Students without suitable preparation in statistics may also be required to take a course at the 400 or 500 level at the adviser's discretion. A student's Ph.D. committee can require additional course work depending on the student's background and research plans.

Code	Title	Credits
Required Courses		
ANTH 508	Visualizing Anthropological Data ¹	3
ANTH 509	Proposal Writing	3
ANTH 541	Current Literature in Integrative Anthropology ²	6
ANTH 560	Ecology, Evolution, and Human Behavior	3
ANTH 571	Principles of Human Evolutionary Biology	3
ANTH 572	Research Design in Integrative Anthropology	3
ANTH 573	Anthropology Research Practicum	3
ANTH 588	Method and Theory in Archaeology	3

¹ ANTH 508 is required for all Ph.D. students and may be taken at any point in the first two years.

² All Ph.D. students are required to enroll in a one-unit literature review seminar (ANTH 541), for one credit each semester during the first six semesters of study.

A student's Ph.D. committee can require reading knowledge and/or demonstrated working knowledge of a foreign language, specialized training in linguistics, or training in computer programming languages, depending on the student's research interests. This will be determined shortly after the committee is formed.

For the Ph.D. degree, students must conduct significant original research that demonstrates the student's mastery of the field. The Ph.D. requirements include successful completion of course work as stipulated by the department and Ph.D. committee, passing the qualifying exam, preparing a dissertation proposal, successfully passing the comprehensive exam/dissertation proposal defense, and writing and defending the subsequent dissertation. The dissertation must be

accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School, and the student must pass a final oral examination (the dissertation defense).

Dual-Titles

Dual-Title Ph.D. in Anthropology and Bioethics

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

The Bioethics program (<http://bulletins.psu.edu/graduate/programs/majors/bioethics/>) provides anthropology students with an opportunity to develop their knowledge of the social and ethical implications of their research. This combination – solid research experience with an intimate knowledge of the ethical dimensions of that work – is increasingly important in the workplace, and broadens the possibilities of employment beyond traditional anthropology positions.

Admissions Requirements

Students must apply and be admitted to the graduate program in Anthropology and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Bioethics dual-title program. Refer to the Admission Requirements section of the Bioethics Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/bioethics/>). Doctoral students must be admitted into the dual-title degree program in Bioethics prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Anthropology, listed above. In addition, students must complete the degree requirements for the dual-title in Bioethics, listed on the Bioethics Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/bioethics/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Anthropology and must include at least one Graduate Faculty member from the Bioethics program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Anthropology and Bioethics. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>), the Ph.D. committee of an Anthropology and Bioethics dual-title Ph.D. student must include at least one member of the Bioethics Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Bioethics, the member of the committee representing Bioethics must be appointed as co-chair. The Bioethics representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Anthropology and Bioethics. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title Ph.D. in Anthropology and Climate Science

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

The Climate Science (<https://bulletins.psu.edu/graduate/programs/majors/climate-science/>) program offers enhanced training opportunities for students interested in investigating the role of climate change in human evolution, socio-natural systems, and contemporary societies.

Admissions Requirements

Students must apply and be admitted to the graduate program in Anthropology and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Climate Science dual-title program. Refer to the Admission Requirements section of the Climate Science Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/climate-science/>). Doctoral students must be admitted into the dual-title degree program in Climate Science no later than the end of the fourth semester (not counting summer semesters) of entry into the primary Ph.D. program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in in Anthropology, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual-title in Climate Science, listed on the Climate Science Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/climate-science/>).

The qualifying examination in Anthropology satisfies the qualifying exam requirement for the dual-title degree program in Climate Science.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>), the Ph.D. committee of an Anthropology and Climate Science dual-title Ph.D. student must include at least one member of the Climate Science Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Climate Science, the member of the committee representing Climate Science must be appointed as co-chair. The Climate Science representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Anthropology and Climate Science. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be

accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title M.A. and Ph.D. in Anthropology and Demography

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

The Demography interdisciplinary program (<http://bulletins.psu.edu/graduate/programs/majors/demography/>) is designed to give students in-depth knowledge of the demographic dimensions of anthropological research, including studies of present populations as well as those of the past.

Admissions Requirements

Students must apply and be admitted to the graduate program in Anthropology and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Demography dual-title program. Refer to the Admission Requirements section of the Demography Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/demography/>). Doctoral students must be admitted into the dual-title degree program in Demography prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Anthropology, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual-title in Demography, listed on the Demography Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/demography/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Anthropology and must include at least one Graduate Faculty member from the Demography program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Anthropology and Demography. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>), the Ph.D. committee of an Anthropology and Demography dual-title Ph.D. student must include at least one member of the Demography Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Demography, the member of the committee representing Demography must be appointed as co-chair. The Demography representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education

in Anthropology and Demography. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title M.A. and Ph.D. in Anthropology and TRANSDISCIPLINARY RESEARCH ON ENVIRONMENT AND SOCIETY

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

The TREES program (<http://bulletins.psu.edu/graduate/programs/majors/human-dimensions-natural-resources-environment/>), which involves four colleges including the College of the Liberal Arts, is oriented toward research that furthers our understanding of the human use of natural resources, a pressing concern for all of us in the twenty-first century. Topics of special concern for anthropologists are the (very) long-term impact of humans on natural settings, and the ways people have adapted to those changes in their surroundings.

Admissions Requirements

Students must apply and be admitted to the graduate program in Anthropology and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the TREES dual-title program. Doctoral students must be admitted into the dual-title degree program in TREES prior to taking the qualifying examination in their primary graduate program. Refer to the Admission Requirements section of the TREES Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/transdisciplinary-research-environment-society/>).

Master's Degree Requirements

In addition to the course requirements, 6 credits of Thesis Research (600 or 610 in the student's home graduate degree program) are required if the candidate is writing a thesis. Particular courses may satisfy both the graduate major program requirements and those of the TREES dual-title intercollege program. All courses must be approved by the student's M.S./M.A. advisers and/or committee.

The thesis supervisor and chair of the student's committee shall be a member of the student's major program, and a member of the dual-title program. All members of the committee must hold Graduate Faculty status or secure the same before serving on the committee.

The culminating experience (e.g., thesis or scholarly paper or capstone course) must incorporate a TREES interest together with the primary field of study. All students are also required to successfully complete an oral defense of the M.S./M.A. thesis as part of the master's requirements if required by the participating program.

Doctoral Degree Requirements

A candidate for the dual-title intercollege TREES Ph.D. must complete, in addition to curricular requirements for the doctoral degree in the student's primary program, a minimum of 15 credits of TREES coursework. The course requirements are the same as those listed for the Master's degrees. All courses, including which courses will satisfy both the graduate major program and dual-title program

requirements, must be approved by the student's M.S./M.SA. advisers and/or committee.

The qualifying examination for Anthropology will satisfy the qualifying exam requirement for the dual-title degree program in TREES. The Ph.D. committee must include at least one Graduate Faculty member from TREES. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. The TREES representative on the Ph.D. committee will participate in constructing and evaluating the comprehensive examination. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in TREES, the member of the committee representing TREES must be appointed as co-chair. All Ph.D. students will be required to complete, present, and defend a dissertation that incorporates a topic related to both their graduate major program and TREES. Candidates for the dual-title Ph.D. degree in TREES will be required to pass a final oral examination (the dissertation defense) covering their graduate major program field and TREES, with emphasis on the student's area of specialization. To earn the Ph.D. degree, doctoral students must also write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title Ph.D. in Anthropology and Microbiome Sciences (MBIOM)

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

The dual-title in Anthropology and Microbiome Sciences (MBIOM) is a great recruitment incentive for students interested in how microbial communities contribute to anthropological processes. Students whose research involves high-throughput microbiome data, bioinformatics analysis, and metadata interpretation can have their training and skills formally recognized with the Dual Title Ph.D. in Microbiome Sciences.

Admissions Requirements

Students must apply and be admitted to the graduate program in Anthropology and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the MBIOM dual-title program. Students enroll in the MBIOM program after admission to their major program but ideally before their qualifying exam (the major program's qualifying exam is sufficient for the dual-title program). In the event the student decides to enroll in the dual-title after taking the qualifying exam, enrollment must occur before the end of the fourth semester. To enroll, the student emails the MBIOM Graduate Program Assistant an application form (see <https://plantpath.psu.edu/graduate/dual-title/microbiome/apply>) (<https://plantpath.psu.edu/graduate/dual-title/microbiome/apply/>) and a statement of interest that includes potential research objectives and is signed by their adviser and major program head. The FIC will review the application and notify Graduate School of enrollment approval.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Anthropology, listed above. In addition, students must complete the degree requirements for the dual-title in Microbiome Sciences (see <https://plantpath.psu.edu/graduate/dual-title/microbiome/objectives>) (<https://plantpath.psu.edu/graduate/dual-title/microbiome/objectives/>).

The qualifying examination for Anthropology satisfies the qualifying examination requirement for the dual-title degree program in Microbiome Sciences.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>), the Ph.D. committee of an Anthropology and MBIOM dual-title Ph.D. student must include at least one member of the MBIOM Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in MBIOM, the member of the committee representing MBIOM must be appointed as co-chair. The MBIOM representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Anthropology and MBIOM. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Integrated Undergrad-Grad Programs

Integrated B.A. degree in Anthropology or B.S. degree in Anthropological Science, B.A. degree in Classics and Ancient Mediterranean Studies (CAMS), and M.A. degree in Anthropology

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The Department of Anthropology offers two integrated undergraduate-graduate (IUG) degree programs (B.A./B.A./M.A. or B.A./B.S./M.A.) designed to allow academically superior students to obtain either a B.A. degree in Anthropology or a B.S. degree in Anthropological Science, a B.A. degree in Classics and Ancient Mediterranean Studies (CAMS), and an M.A. degree in Anthropology in five years of study.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students who are applying to the Integrated Undergraduate and Graduate (IUG) program must complete the Graduate School application for admission (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet all the admission requirements of the Graduate School and the Anthropology IUG graduate program, listed on the Admission Requirements tab. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll

in an IUG. Criteria for admission include a minimum GPA of 3.4 in their majors, strong recommendation letters from faculty, and an excellent proposal for a research project with a specific adviser who has agreed to guide the student through to the completion of the M.A. thesis or scholarly paper. In consultation with this adviser, students must prepare a plan of study appropriate to this integrated program, and must present their plan of study to the head of the graduate program or the appropriate committee overseeing the integrated program prior to being admitted to the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.A. in Anthropology, B.A. in Classics and Ancient Mediterranean Studies, and B.S. in Anthropological Science are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.A. degree are listed below. Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
ANTH 541	Current Literature in Integrative Anthropology	1
ANTH 560	Ecology, Evolution, and Human Behavior	3
ANTH 571	Principles of Human Evolutionary Biology	3
ANTH 588	Method and Theory in Archaeology	3

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.A. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Joint Degrees

Joint M.D. / Ph.D. with the College of Medicine

Requirements listed here are in addition to requirements listed in GCAC-211 Joint Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-211-joint-degree-programs/>).

Admission Requirements

Prospective students interested in simultaneously pursuing a M.D. and Ph.D. degree must apply to the College of Medicine M.D. program using the national American Medical College Application Service (AMCAS) application system and indicate their intent to pursue the joint-degree program. Admissions requirements and applications for admission for Penn State College of Medicine are available at the M.D. Program (<http://med.psu.edu/md/>) section of the Penn State College of Medicine website. Applicants must also meet the admission requirements of the Graduate School and the Ph.D. admission requirements listed on the

Admission Requirements tab, however, the requirement for GRE scores is waived for students applying to the joint degree program.. The M.D./Ph.D. Admissions Committee reviews applications and evaluates candidates for acceptance into both the M.D. and Ph.D. programs. After the review committee has accepted an applicant to the joint degree program, s/he must apply to the Graduate School (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>) for admission to the graduate program. Applicants not accepted into the joint-degree program may be referred to either the M.D. or Ph.D. program, depending on their qualifications.

Applicants to this program generally have very strong grades and MCAT scores, as well as a strong and sustained background in research. Applicants must be able to clearly articulate reasons for pursuing the joint degree. Letters of recommendation from faculty who have advised the applicant in research and who can comment on the applicant's passion and potential for research are strongly encouraged.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits outlined below. Degree requirements for the M.D. program are listed on the Penn State College of Medicine website (<http://www.med.psu.edu/web/md/home/>). For students enrolled in the joint degree program, the requirement for ANTH 572 and ANTH 573 will be waived, and students will be required to complete 2 credits of ANTH 541 instead of 6. The College of Medicine will accept 8 credits of ANTH 600 in lieu of two months of elective rotations (MED 797). In addition, the College of Medicine waives the requirement for a Medical Student Research project for students in the M.D./Ph.D. program.

If students accepted into the joint degree program are unable to complete the M.D. degree, they are still eligible to receive the Ph.D. degree if all the Ph.D. degree requirements have been satisfied.

In addition to the requirements for the Ph.D. committee (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>) for a Ph.D. student in the ANTH Graduate Program, at least one member of the Ph.D. committee must be on the M.D./Ph.D. Steering Committee. This member may serve other roles on the Ph.D. committee.

M.D./Ph.D. students must complete 25 credits. Candidates for the M.D./Ph.D. in ANTH will take all of the core courses for the ANTH Ph.D., as well as electives chosen by the ANTH M.D./Ph.D. student in consultation with their primary mentor. In the first semester of the second year at UP, all students in the ANTH Ph.D. program are required to take ANTH 509, the research methods seminar. ANTH 508, Anthropological Data Analysis and Visualization, is also required for all ANTH Ph.D. students and may be taken at any point in the first two years. Students without suitable preparation in statistics may also be required to take a course at the 400 or 500 level at the advisor's discretion. At any point during the first two years, M.D./Ph.D. students may be required to take up to 6 additional credits of advanced seminars, as directed by their adviser. The M.D./Ph.D. students pursuing the ANTH Ph.D. are also required to enroll in a one-unit literature review seminar (ANTH 541) for one credit each semester during the first two semesters of study. In addition to taking the required core courses and the literature review course, six credits of elective courses may be required in consultation with the student's dissertation adviser and Ph.D. committee. Eight credits of ANTH 600 conducted over the four years of the graduate portion of the training program will be counted by the College of Medicine in lieu of two months of elective rotations

(MED 797). The College of Medicine's requirement for a Medical Student Research project is also waived for all M.D./Ph.D. in ANTH candidates.

The Ph.D. committee of an M.D./Ph.D. student in ANTH will be formed upon successful passing of the ANTH qualifying examination and commencement of work under a primary mentor, no later than the end of the first semester of the second year of graduate study at UP. The committee must include at least two members of the ANTH graduate faculty and one member of the M.D./Ph.D. steering committee.

The comprehensive examination for ANTH M.D./Ph.D. students will follow the same guidelines as for Ph.D. students in ANTH, except that the comprehensive examination must be held before the end of the second academic year at UP. The M.D./Ph.D. student must write a dissertation proposal in preparation for the comprehensive exam, and a final version of the dissertation proposal must be circulated by the student to all committee members at least four weeks in advance of the comprehensive exam. The comprehensive examination for M.D./Ph.D. students will be an oral examination which may be open to the public. The examination will consist of student presentation of their dissertation proposal, followed by questions and discussion.

The dissertation requirements for ANTH Ph.D. and ANTH M.D./Ph.D. students are the same: All Ph.D. candidates must conduct original research and prepare a dissertation that makes a significant contribution of new knowledge, is presented in a scholarly manner, and demonstrates an ability on the part of the candidate to do independent research of high quality. The contents and conclusions of the dissertation must be defended at the time of the final oral examination.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Anthropology (ANTH) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/anth/>)

Learning Outcomes

Doctor of Philosophy (Ph.D.)

1. Graduates will demonstrate comprehensive understanding of the history and current knowledge and theory in the field of Anthropology through written works, oral presentations and teaching endeavors.
2. Graduates will be able to identify research questions in anthropology, develop a research design to examine questions using appropriate data collection methods, analyze the data using appropriate statistical methodology, and interpret the results of data analysis.
3. Demonstrate effective communication of research ideas in written works and oral presentations. Demonstrate effective communication of current topics in Anthropology through development of clear and engaging lectures and assignments for undergraduate courses.
4. Graduates will be able to develop an effective, original research proposal that is framed by current anthropological theory and methods.
5. Graduates will demonstrate knowledge of the professional standards of scholarly and professional work in their field of anthropology through their written and oral works and interactions with colleagues.

Contact

Campus	University Park
Graduate Program Head	Tim Ryan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	David Andrew Puts
Program Contact	Audrey Michelle Chambers 414 Carpenter Building University Park PA 16802 amv14@psu.edu (814) 865-2509
Program Website	View (http://anth.la.psu.edu/)

Applied Behavior Analysis

Graduate Program Head	Raffy Luquis
Program Code	ABA
Campus(es)	Harrisburg (M.A.)
Degrees Conferred	Master of Arts (M.A.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=ABA)

Human behavior contributes to many problems humans face. Adults disposing of trash along the road, children engaging in behaviors impeding learning, or people with diabetes not taking insulin or following diet plans – all human behaviors. The Penn State Harrisburg Applied

Behavior Analysis program uses the science-practitioner model to prepare students to apply the core areas of behavior analysis to a variety of individual and social problems in a variety of settings. The ABA program represents a discipline that can be applied in a number of fields (e.g., autism, education, health, psychology, medicine, business).

The Verified Course Sequence was designed to provide an in-depth understanding of behavioral research and intervention, the foundations of the science of behavior, ethical research and practice, and behavioral skill application across behaviors and environments. The courses sequence meets the course and experience requirements according to the national certification board and promotes research in the field. Students who successfully complete the program will be expected to possess the skills and abilities of an emerging expert in ABA. Graduates of the Penn State Harrisburg ABA program provide this expertise to a wide range of individuals across a multitude of settings within the region and across the globe.

The program is intended for both part- and full-time students. Courses will be scheduled for fall, spring, and summer semesters. Admission is in the fall and spring semesters only. However, the program encourages fall admission and typically reserves spring admission for exceptional circumstances on a case-by-case basis.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students will be admitted on a competitive basis and must submit the online application including the following:

- a completed Graduate School online application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) and payment of the nonrefundable application fee
- official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>)
- three letters of recommendation. At least one of these recommendations should be from a professor or person who can comment on the student's academic qualifications. Recommendations addressing the applicant's experience with ABA is recommended, but not required.

The program prefers that applicants have at least 18 credit hours in education, psychology, ABA, or a related discipline with a cumulative grade-point average of 3.0 or above. GRE scores are not required for admission, but students who do not submit GRE scores will not be eligible for most graduate assistantships and/or scholarships. A personal interview may be required. Applications will be reviewed only after a complete application has been received. A complete application and meeting of minimal requirements does not ensure admission into this competitive program.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Transfer Credits

Credits earned at other institutions but not used to earn a degree may be applied toward the requirements for a graduate degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>).

Review of classes taken at other institutions and their relationship to equivalent classes in the ABA program will be conducted by the ABA program faculty. Although classes from other institutions may be within the field of ABA, they may not directly transfer to the ABA program's representation of classes within the Verified Course Sequences. The ABA program cannot guarantee approval by the Behavior Analysis Certification Board (BACB) of courses taken at other institutions, even those institutions that also have BACB University Approved Coursework. Relationships of the ABA program courses to the Verified Course Sequence Requirements can be obtained from the ABA program Professor in Charge.

Degree Requirements

Master of Arts (M.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Requirements for the M.A. in Applied Behavior Analysis include 36 credits in required course work, including the culminating experience and supervised internship experience, and at least 3 elective credits for a total of 39 credits.

ABA Core Courses (to be offered at least annually) are required for all students in the program.

Code	Title	Credits
Required Courses		
ABA 500	Science and Behaviorism	3
ABA 510	Behavioral Assessment and Intervention: Functional Skills	3
ABA 512	Behavioral Assessment and Intervention: Problem Behavior	3
ABA 522	Behavioral Research Methods	3
ABA 533	Principles of Behavior Analysis	3
ABA 534	Advanced Principles of Behavior Analysis	3
ABA 544	Behavioral Systems Support	3
ABA 588	Ethics in Research and Professional Practice	3
ABA 595	Internship	9
Electives		
	Additional courses that will count as electives towards this degree can be chosen from a list of approved elective courses maintained by the graduate program office.	3
Culminating Experience		
ABA 594A	RESEARCH TOPICS ¹	3
Total Credits		39

¹ The culminating experience for the degree requires the completion of a scholarly paper. Examples of scholarly papers can include empirical research, training and manual construction, publication style literature reviews, etc. All scholarly papers must relate to Applied Behavior Analysis and illustrate advanced knowledge of the research or

concepts. Type and scope of the scholarly paper is agreed upon by the student's research chair and second reader.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Applied Behavior Analysis (ABA) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/aba/>)

Learning Outcomes

1. Develop a comprehensive and scientifically rigorous single-case design research study that conforms to the standards of the discipline.
2. Critically evaluate research and clinical practice and apply the ethical guidelines and practice standards outlined by the Behavior Analysis Certification Board.
3. Describe the influence and relation of EAB and behaviorism to ABA and clinical practice/research.
4. Critically evaluate and apply basic and complex principles of behavior analysis.

5. Conduct a comprehensive functional behavior assessment. The assessment should conform to discipline standards.
6. Develop a comprehensive treatment plan. The treatment plan should conform to discipline standards.
7. Critically evaluate basic, applied, and translational research, and identify the implications for research and clinical practice.

Professional Licensure/Certification

Many U.S. states and territories require professional licensure/certification to be employed. If you plan to pursue employment in a licensed profession after completing this program, please visit the Professional Licensure/Certification Disclosures by State (<https://www.psu.edu/state-licensure-disclosures/>) interactive map.

Contact

Campus	Harrisburg
Graduate Program Head	Raffy Reinaldo Luquis
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Jonathan William Ivy
Program Contact	Jeri S. Fisher Penn State Harrisburg, W311 777 W. Harrisburg Pike Middletown PA 17057-489 jsf5@psu.edu (717) 948-6034
Program Website	View (https://harrisburg.psu.edu/behavioral-sciences-and-education/social-sciences-and-psychology/master-arts-applied-behavior-analysis/)

Applied Linguistics

Graduate Program Head	Tommaso Milani
Program Code	APLNG
Campus(es)	University Park (Ph.D.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Dual-Title Ph.D. in Applied Linguistics and African Studies Dual-Title Ph.D. in Applied Linguistics and Asian Studies
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=APLNG)

The Ph.D. in Applied Linguistics helps prepare scholars who will conduct systematic examinations of individual and societal multilingualism in order to build and test theories of how linguistic systems develop, are acquired, used, and taught in global contexts. The Ph.D. degree program includes the foundational theory and research of linguistics, applied linguistics, second language acquisition, psycholinguistics, and sociolinguistics. It will prepare doctoral students to utilize a range of research perspectives, both qualitative and quantitative, e.g., sociocultural, historical, linguistic, stylistic, discourse analytical. Overall, the purpose of the research undertaken in graduate study in Applied Linguistics will be to illuminate, in all its complexity, the multiple dimensions of the study of language as a mode of social existence, communication, and cognition.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Applicants are required to submit official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>). In addition, scores from the Graduate Record Examinations (GRE) are required for applicants who have received a degree from an institution of higher education in the United States or abroad in which the medium of instruction is English. GRE scores are optional for applicants who have received a degree from an institution of higher education in which the medium of instruction is a language other than English. All applicants are required to submit:

- three letters of reference (at least two from faculty with whom the applicant has studied) evaluating aptitude for doctoral study
- at least one sample of scholarly writing (published or unpublished research paper, thesis, etc.)
- an academic statement describing their teaching and research experience and their specific professional goals and interests

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Applicants to the Applied Linguistics program must have a score of 600 or higher on the TOEFL paper-based test. In addition, international applicants are encouraged to submit a cassette tape recording on which they describe their career goals and the reasons for wanting to pursue doctoral studies at Penn State.

Degree Requirements

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

qualifying examination

In the third semester (a minimum of 18 credits) of graduate study, all students must satisfactorily complete a qualifying evaluation in which they are required to present a portfolio of work completed in their program of study. The portfolio will include a transcript of the student's academic record, a program plan, samples of scholarly work in Applied Linguistics and related areas, and a brief description of the proposed dissertation research, showing relevant course work completed and projected. Following submission of this portfolio, the student will meet with the members of his/her Ph.D. committee for an oral qualifying evaluation. The purpose of this evaluation is threefold:

1. to determine whether the student has achieved a level of learning and understanding sufficient to justify continuing in the program,
2. to discover what further study is required to bring the student to the competence required for the research being proposed, and

3. to secure approval of a program of course work and independent study to achieve the requisite competence. The particulars of each student's program of study and research are defined on the basis of the qualifying evaluation.

English Language Competence

During course work prior to the qualifying examination, students will be assessed for communicative competence in reading, writing, and speaking English. Should a higher level of competence be required, the student will be directed to the appropriate resources. International candidates will be advised that the passage of the minimal TOEFL requirement does not demonstrate the level of competence required for completion of the Ph.D. program.

Additional Language Competence

All students must demonstrate competence in reading relevant research literature in one language other than English and intermediate speaking competence in an additional language. The additional language competence requirements may be demonstrated in a variety of ways.

Ph.D. Committee Composition

The Ph.D. committee must meet all Graduate Council requirements (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>). Members of the Graduate Faculty with courtesy appointments in LALS who are members of the Applied Linguistics Graduate Faculty may serve as the chair of the Ph.D. committee with approval of the Director of LALS.

Comprehensive Examination

All doctoral students must pass a comprehensive examination designed to assess mastery of and ability to synthesize and integrate theoretical issues in Applied Linguistics. This examination is taken upon completion of all course work. The content and format of the comprehensive exam will be established by the members of the candidate's Ph.D. committee in accordance with degree requirements of LALS and consist of two course papers that are of publishable quality and two or three research papers based on questions developed by members of the Ph.D. committee. The original papers must be submitted by end of semester prior to that in which the student plans to take the comprehensive exam. The student will be given two months' time in which to complete and submit these exam papers. Within three weeks of submission of the exam papers, the student will take an oral exam based on the original research papers and the exam papers. Students who fail the examination on the first attempt may repeat it once. Students who fail the examination the second time will not be permitted to continue in the program.

Dissertation

Each doctoral candidate is required to conduct an original and independent research project representing a significant contribution to knowledge in the field of study. The project should be presented in a scholarly manner, show an ability on the part of the candidate to do independent research of high quality, and demonstrate considerable experience in using appropriate research techniques. The content and conclusions of the dissertation will be defended at the time of the final oral examination. A written dissertation proposal is required and must be approved at a proposal hearing by a majority vote of the candidate's Ph.D. committee. A majority vote is also required for approval of the completed written dissertation at the final oral defense. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Titles

DUAL-TITLE PHD IN APPLIED LINGUISTICS AND AFRICAN STUDIES

The goal of the dual-title degree in Applied Linguistics and African Studies is to enable graduate students from Applied Linguistics to acquire the knowledge and skills of their major area of specialization in Applied Linguistics while gaining the perspective from specialists in African Studies.

This program provides graduate students with a solid disciplinary foundation that will allow them to compete for the best jobs in their field. The dual-title PhD in Applied Linguistics and African Studies will enable these students to transform the traditional boundaries of their fields and become experts in African Studies and will add value to their status as candidates. Overall, the dual-title degree in Applied Linguistics and African Studies will build curricular bridges beyond the student's major field to provide a unique training regime for global scholarship.

ADMISSION REQUIREMENTS

The PhD in Applied Linguistics and African Studies is open to students who are admitted to the Applied Linguistics doctoral program and, subsequently, to the dual-title degree program in African Studies. Doctoral students must be admitted into the dual-title degree program in African Studies prior to taking the qualifying examination in their primary graduate program.

Applicants interested in the program should make their interest in the dual-title degree program known on their applications and include remarks in their essays that explain their training, interests, and career goals in an area of African Studies.

DEGREE REQUIREMENTS

To qualify for an African Studies degree, students must satisfy the requirements of the Applied Linguistics program in which they are primarily enrolled as well as the requirements described below, as established by the African Studies committee. Within this framework, the final course selection is determined by the student and their African Studies and Applied Linguistics program advisors.

Upon a student's acceptance by the African Studies Admissions Committee, the student will be assigned an African Studies academic advisor in consultation with the African Studies chair. As students develop specific scholarly interests, they may request that a different African Studies faculty member serve as their advisor. The student and advisor will discuss a program of study that is appropriate for the student's professional objectives and that is in accord with the policies of the Graduate School, Applied Linguistics Department, and African Studies program.

The PhD in Applied Linguistics and African Studies is awarded only to students who are admitted to the Applied Linguistics doctoral program and to the dual-title degree in African Studies.

REQUIRED COURSES IN APPLIED LINGUISTICS

The basic coursework requirement for APLNG students entering with an MA degree is 37 credits (excluding 8 for doctoral dissertation writing), including one from a proseminar and four semesters with 9 credits each. Six of these credits can be double counted toward the AFR requirement.

Students taking the dual-title degree will have to enroll for an additional 12 credits in AFR putting the total for coursework at 49 credits. In this

dual-title degree, students are expected to do coursework until Year 3. They concentrate on writing their dissertation in Years 4 and 5.

On rare occasions, the program may admit exceptionally qualified students entering the program with B.A. degree only. To satisfy the coursework requirements in both programs, these students will need 54 credits in APLNG and 12 credits in AFR beyond the 6 double counted APLNG credits. These students will be counseled to take advantage of summer credit options and will be permitted one or two semesters of 12 credits such that they may complete their comprehensive examinations in the 7th semester.

The minimum course requirements for the PhD in Applied Linguistics are listed below:

Code	Title	Credits
Foundations		
APLNG 580	Proseminar in Applied Linguistics	1
APLNG 582	Seminar in Approaches to Language Use	3
APLNG 591	Seminar in Second Language Acquisition	3
Research Methodologies		
Students are required to take a minimum of 12 credits, part of which includes the 6-credit course sequence APLNG 577 and APLNG 593:		12
APLNG 575	Language Ideology	
APLNG 576	Language Socialization across Home, School, and Community Contexts	
APLNG 577	Language Analysis	
APLNG 578	Computational and Statistical Methods for Corpus Analysis	
APLNG 581	Discourse Analysis	
APLNG 586	Analyzing Classroom Discourse	
APLNG 592	Qualitative Research in Applied Linguistics	
APLNG 593	Experimental Research on Language	
Additional Courses		
In consultation with their academic advisor, students are required to take a minimum of 18 credits of additional courses:		18
APLNG 510	Health and Aging in Multilingual Contexts	
APLNG 511		
APLNG 570	Second Language Reading	
APLNG 571	Usage-Based Approaches to Second Language Learning and Teaching	
APLNG 572	Communication in Second Language Classrooms	
APLNG 512	Language and Adult Lifespan Development	
APLNG 574	World Englishes: Pluralizing Policy, Pedagogy, and Proficiency	
APLNG 575	Language Ideology	
Africa-Related Course Work		
APLNG 597	Special Topics	

REQUIRED COURSES IN AFRICAN STUDIES

To satisfy the conditions for the dual-title degree, the student must additionally complete the following African Studies requirements:

Code	Title	Credits
Africa-Related Coursework		
18 credits of Africa-related coursework at the 400 or 500 level, of which the following are required.		

Students may choose from one of the two courses below:

AFR 501	Key Issues in African Studies
AFR 505	African Studies Methodology
A minimum of 6 credits from:	
AFR 510	Post-Colonial Theory
AFR 512	Decolonial Methods for Interdisciplinary Research
AFR 520	Readings in African History
AFR 526	African Social and Cultural Systems
AFR 530	Perspectives on African Language Research in the Global South

Double counting is allowed, and up to 6 of the 18 credits may come from Africa-related courses in Applied Linguistics or other units, as approved by the student's Applied Linguistics and African Studies Program academic advisors.

No more than 6 credits may be taken at the 400 level, and no more than 6 combined credits may come from individual studies courses and/or foreign studies courses.

The choice of additional courses in African Studies is to be proposed by the student, subject to approval by the Applied Linguistics and African Studies advisors. The suite of selected courses should have an integrated, intellectual thrust that probes a thematic, national, or regional issue and that is complementary to the student's specialty in the primary program.

LANGUAGE REQUIREMENT

Communication and foreign language requirements will be determined by the student and the Applied Linguistics and African Studies Program advisors in accordance with the existing Applied Linguistics language requirements.

Qualifying EXAM

The dual-title degree will be guided by the qualifying exam procedure of the Applied Linguistics graduate program. The qualifying exam for the dual-title degree may be given after at least 18 post-baccalaureate credits have been earned in graduate courses; it must be taken within three semesters (summer sessions do not count) of entry into the Applied Linguistics graduate program. The dual-title degree student may require one additional semester to fulfill requirements for the dual-title degree program. The qualifying examination may, therefore, be delayed by a semester. There will be a single qualifying examination that contains elements of the major discipline and African Studies.

The qualifying examination committee for the dual-title degree will be composed of graduate faculty from Applied Linguistics and at least one graduate faculty member from the African Studies Program. The designated dual-title faculty member may be appointed from Applied Linguistics if that person holds a formal appointment with the African Studies Program.

COMMITTEE COMPOSITION

The doctoral committee of a dual-title degree student must include a minimum of four faculty members, i.e., the chair and at least three additional members, all of whom must be members of the graduate faculty. In addition to the general Graduate Council requirements for Ph.D. committees, the committee must include at least one member of the African Studies Graduate Faculty. Faculty members who hold Graduate Faculty appointments in both Applied Linguistics and African Studies may serve in a combined role. If the chair of the Ph.D. committee is not

a member of the Graduate Faculty in African Studies, the member of the committee representing African Studies must be appointed as co-chair.

COMPREHENSIVE EXAM

After completing all coursework, doctoral candidates for the dual-title degree in Applied Linguistics and African Studies must pass a comprehensive examination that includes written and oral components. Written components will be administered for a candidate's major Applied Linguistics subfield and African Studies. The Comprehensive Examination will be made up of two questions jointly composed by the student's committee under the direction of the chair of the student's PhD committee.

DISSERTATION AND DISSERTATION DEFENSE

Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn a PhD. Students enrolled in the dual-title program are required to write and orally defend a dissertation on a topic that reflects their original research and education in Applied Linguistics and African Studies.

Dual-Title Ph.D. in Applied Linguistics and Asian Studies

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Graduate students with research and educational interests in Asian Studies may apply to the Applied Linguistics/Asian Studies Degree Program. The goal of the dual-title degree Applied Linguistics and Asian Studies is to enable graduate students from Applied Linguistics to acquire the knowledge and skills of their major area of specialization in Applied Linguistics while at the same time gaining the perspective of Asian Studies.

In order to prepare graduate students for the competitive job market, this program provides them with a solid disciplinary foundation that will allow them to compete for the best jobs in their field. For such students the dual-title Ph.D. in Asian Studies will add value to their degree and their status as candidates. It will produce excellent linguists who are experts in Asian Studies as well. The dual-title degree in Applied Linguistics and Asian Studies will build curricular bridges beyond the student's major field so as to provide a unique training regime for the global scholar.

Admission Requirements

For admission to the dual-title Ph.D. degree under this program, a student must first apply and be admitted to the Applied Linguistics graduate program. Once accepted into the Applied Linguistics program, the student can apply to the Admissions Committee of the Asian Studies. The Asian Studies Admissions Committee reviews applications and recommends students for admission to the Asian Studies program to the Graduate School. Refer to the Admission Requirements section of the Asian Studies Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/asian-studies/>). Doctoral students must be admitted into the dual-title degree program in Asian Studies prior to taking the qualifying examination in their primary graduate program. Applicants interested in the program should also make their interest in the dual-title degree program known clearly on their applications and include remarks in their essays that explain their training, interests, and career goals in an area of Asian Studies.

Degree Requirements

To qualify for an Asian Studies degree, students must satisfy the requirements of the Applied Linguistics program in which they are

primarily enrolled. In addition, they must satisfy the requirements described below, as established by the Asian Studies committee. Within this framework, final course selection is determined by the student, their Asian Studies adviser, and their Applied Linguistics program adviser.

Upon a student's acceptance by the Asian Studies Admissions Committee, the student will be assigned an Asian Studies academic adviser in consultation with the Asian Studies chair. As students develop specific scholarly interests, they may request that a different Asian Studies faculty member serve as their adviser. The student and adviser will discuss a program of study that is appropriate for the student's professional objectives and that is in accord with the policies of The Graduate School, the Applied Linguistics department and the Asian Studies program.

The doctoral degree in Applied Linguistics and Asian Studies is awarded only to students who are admitted to the Applied Linguistics doctoral program and admitted to the dual-title degree in Asian Studies. The minimum course requirements for the dual-title Ph.D. degree in Applied Linguistics and Asian Studies are as follows:

60 credits beyond the master's degree, including:

Code	Title	Credits
Required Courses		
APLNG 580	Proseminar in Applied Linguistics	1
<i>Foundations Courses</i>		
Select 6 credits, which may include but need not be limited to the following:		6
APLNG 591	Seminar in Second Language Acquisition	
APLNG 597	Special Topics	
<i>Research Methods</i>		
Select 6 credits, which may include but need not be limited to the following:		6
APLNG 593	Experimental Research on Language	
APLNG 597	Special Topics	
APLNG 581	Discourse Analysis	
APLNG 586	Analyzing Classroom Discourse	
<i>Asia-related Coursework</i>		
ASIA 501	Proseminar in Asian Studies I	3
ASIA 502	Proseminar in Asian Studies II	3
Select 9 credits at the 400 or 500 level ¹		9
<i>Electives</i>		
Select 6 credits in Applied Linguistics electives, in consultation with the applied linguistics adviser		6
Language Requirement		
All-skills proficiency in one Asian language AND intermediate speaking competence in an additional language other than English		
Total Credits		34

¹ As many as 6 may come from Applied Linguistics, as approved by the student's doctoral adviser and the Asian Studies Program director of graduate studies. The remaining credits can be taken in ASIA or in any department other than Applied Linguistics.

Particular courses may satisfy both the Applied Linguistics requirements and those of the Asian Studies program. Final course selection is

determined by the student in consultation with their dual-title program advisers and their major program advisers.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Applied Linguistics (APLNG) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/aplng/>)

Learning Outcomes

1. Graduates will demonstrate command of historical and current developments in applied linguistics theory and the current literature relevant to a particular theoretical topic and research area in applied linguistics.
2. Graduates will demonstrate command of current developments in research methods in applied linguistics and ability to collect and adequately analyze data appropriate for addressing specific research questions.
3. Graduates will demonstrate ability to design and execute original, independent research projects to significantly advance theory and knowledge in applied linguistics.

4. Graduates will demonstrate ability to clearly and effectively report their research in both oral presentations and written formats using appropriate conventions of the discipline.
5. Graduates will demonstrate knowledge of and commitment to the professional and ethical standards of scholarly and professional work in applied linguistics.

Contact

Campus	University Park
Graduate Program Head	Tommaso M Milani
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Celeste S Kinginger
Program Contact	Nicole Marie Schwindenhammer 234 Sparks Building University Park PA 16802 nmf119@psu.edu (814) 867-4284
Program Website	View (http://aplng.la.psu.edu/programs/ph-d-degree-in-applied-linguistics/)

Architectural Engineering

Graduate Program Head	James Freihaut
Program Code	AE
Campus(es)	University Park (Ph.D., M.S., M.A.E., M.Eng.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Master of Architectural Engineering (M.A.E.) Master of Engineering (M.Eng.) Integrated Bachelor of Architectural Engineering (B.A.E.) and Master of Science (M.S.) in Architectural Engineering Integrated Bachelor of Architectural Engineering (B.A.E.) and Master of Architectural Engineering (M.A.E.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=AE)

Students may specialize in building construction, building illumination systems, building mechanical and energy systems, or building structural systems.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Scores from the Graduate Record Examinations (GRE) are required for admission to the Ph.D. and M.S. programs. GRE scores are not required for admission to the M.Eng. degree program.

Students with a 3.00 junior/senior grade-point average (on a 4.00 scale) and with appropriate course backgrounds will be considered for

admission to the AE graduate programs. Students accepted into the Architectural Engineering program generally have an undergraduate degree in:

- mechanical engineering
- electrical engineering
- civil engineering
- architectural engineering
- science
- or architecture

All degree candidates are required to provide a letter of intent outlining the student's intended area of study as well as three letters of recommendation. The best-qualified applicants will be accepted up to the number of spaces that are available for new students.

Degree Requirements

All students in the M.Eng., M.S., and Ph.D. programs must also attend a minimum of 10 approved lectures during their degree program.

M.Eng. in Architectural Engineering

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The M.Eng. in Architectural Engineering degree is a non-thesis professional master's degree. Candidates for the M.Eng. degree are required to complete 30 credits of course work. A minimum of 18 credits must be at the 500 level. Students must follow the approved program of courses for one of the four available specialty areas. Minor modifications to these programs are permitted, with approval of the Graduate Program Officer. Each student must also complete a capstone project supervised by a member of the Graduate Faculty, completed while enrolled in AE 596. The capstone project requires students to work individually or within a group on an aspect of architectural engineering of their choosing. The project should demonstrate the ability of the student to integrate and apply concepts and techniques learned in the program courses.

M.S. in Architectural Engineering

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A thesis is required for the M.S. degree, which consists of a minimum of 30 credits: 24 credits of course work and a 6-credits of thesis research, either AE 600 or AE 610. A minimum of 12 of the course credits must be completed at the 500 level. A student's program of courses in the M.S. program is developed in cooperation with the student's academic adviser.

Ph.D. in Architectural Engineering

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

For the Ph.D. degree, a dissertation that displays a student's ability to conduct high-quality original scholarly work is required of all Ph.D. students. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School. Each student accepted into the Ph.D. degree program must pass the Ph.D. Qualifying Examination, which requires students to display an understanding of basic material in all AE option areas, along with an

in-depth understanding of material covered in the AE undergraduate courses within their area of focus. This examination must be taken no later than the beginning of the student's second year in the program. Each Ph.D. student must also pass an English Proficiency Examination that is administered by the department, typically during the first semester. The English Proficiency Examination must be passed before scheduling the Comprehensive Examination. The student's program of courses is developed in cooperation with the student's Ph.D. committee. It is recommended that this consist of approximately 30 credits of courses beyond the master's degree, although there is no established minimum or maximum. At the conclusion of the student's course work, the Ph.D. student must pass a two-day written comprehensive examination that is developed by the student's Ph.D. committee. Following the comprehensive exam, continuous registration is required for all Ph.D. graduate students until the dissertation is approved. Each student presents a comprehensive dissertation proposal to his/her committee prior to starting his/her dissertation research and must present the results of this research in a final oral examination.

Integrated Undergrad-Grad Programs

Integrated Bachelor of Architectural Engineering (B.A.E.) and Master of Architectural Engineering (M.A.E.) or Master of Science (M.S.) in Architectural Engineering

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

A limited number of undergraduate students in the B.A.E. program will be considered for admission to one of two integrated undergraduate-graduate degree programs. The first leads to the student earning both the B.A.E. and M.A.E. degrees and involves a graduate-level component in the capstone senior project. The second provides the student with the opportunity to earn both the B.A.E. and M.S. degrees and involves a research-oriented thesis in addition to the capstone undergraduate senior project.

Students must apply to and meet admission requirements of the Graduate School, as well as the graduate program in which they intend to receive their master's degree. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.

Application materials for both programs are available on the AE Department website. To be considered for admission to either program, students must have attained a GPA of at least 3.0 and a grade of C or better in all classes listed as AE. A commitment from an AE Graduate Faculty member to serve as the student's M.S. thesis adviser is

necessary for admission to the B.A.E./M.S. program. In consultation with an adviser, students must prepare a plan of study appropriate to this integrated program. Students must present their plan of study to the head of the graduate program or the appropriate committee overseeing the integrated program prior to being admitted to the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.

Degree Requirements

Students admitted to an integrated program (B.A.E./M.A.E. or B.A.E./M.S.) must maintain a GPA in all classes used toward the M.A.E. or M.S. degree of at least 3.0. For both the integrated B.A.E./M.A.E. and B.A.E./M.S. degree programs, 30 credits of the 172 total credits required to receive both degrees are applied toward the master's degree (up to 12 credits count toward both degrees). For the B.A.E./M.S. a minimum of 18 credits is required at the 500 and 600 level combined. For the B.A.E./M.A.E., a minimum of 18 credits is required at the 500 or 800 levels, with at least 6 credits at the 500 level. For the B.A.E./M.A.E. degree program, all of graduate credits are course credits. For the B.A.E./M.S. degree program, a thesis is required and six credits of thesis research (AE 600 or AE 610) must be included in the candidate's academic course plan. Approved integrated program course sequences are available for each of the four undergraduate option areas. These sequences specifically identify the 12 credits of courses that count toward both degrees. The courses that can double-count for the B.A.E./M.A.E. are as follows:

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees: B.A.E./M.A.E.		
AE 457	HVAC Control Systems	3
AE 461	Architectural Illumination Systems & Design	3
AE 467	Advanced Building Electrical System Design	3
AE 475	Building Construction Engineering I	3
AE 476	Building Construction Engineering II	3
AE 570	Production Management in Construction	3
AE 557	Centralized Cooling Production and Distribution Systems	3
AE 565	Daylighting	3

The courses that can be double-counted for the B.A.E./M.S. are as follows:

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees: B.A.E./M.S.		
AE 430	Indeterminate Structures	3
AE 457	HVAC Control Systems	3
AE 461	Architectural Illumination Systems & Design	3
AE 467	Advanced Building Electrical System Design	3
AE 475	Building Construction Engineering I	3
AE 476	Building Construction Engineering II	3
AE 530	Computer Modeling of Building Structures	3
AE 557	Centralized Cooling Production and Distribution Systems	3
AE 558	Centralized Heating Production and Distribution Systems	3
AE 562	Advanced Lighting System Modeling	3
AE 565	Daylighting	3
AE 570	Production Management in Construction	3

At least 6 of the double-counted credits must be at the 500- or 800-level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Each student must submit a course plan detailing the graduate component for approval when applying to this program and must request approval from the Graduate Program Officer for any proposed modifications to this plan following admission to the program. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.A.E. or the M.S. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

A limited number of research and teaching assistantships, scholarships, and fellowships are available to M.S. and Ph.D. students in the Department of Architectural Engineering. The intent of these assistantships and awards is to support students conducting research under faculty supervision. For this reason, students in the M.S. and Ph.D. programs who receive these types of financial support are expected to complete their degree program, including the thesis or dissertation, and may not transfer to the Master of Engineering degree program.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Architectural Engineering (AE) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/ae/>)

Contact

Campus	University Park
Graduate Program Head	James Freihaut
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Julian Wang
Program Contact	Latrisha Hough 104 Engineering Unit A University Park PA 16802 ldw5@psu.edu
Program Website	View (http://www.engr.psu.edu/ae/degree_programs/graduate.asp)

Architecture

Graduate Program Head	Frank Jacobus
Program Code	ARCH
Campus(es)	University Park (M.Arch., M.S., Ph.D.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Master of Architecture (M.Arch.) Dual-Title M.S. and Ph.D. in Architecture and Transdisciplinary Research on Environment and Society Integrated B.Arch. in Architecture and M.S. in Architecture
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=ARCH)

The M.Arch. program is a professional degree program focused on preparation to practice architecture for students who hold a bachelor's degree. The M.Arch. degree is accredited by the National Architectural Accrediting Board. "In the United States, most state registration boards require a degree from an accredited professional degree program as a prerequisite for licensure. The National Architectural Accrediting Board (NAAB), which is the sole agency authorized to accredit U.S. professional degree programs in architecture, recognizes three types of degrees: the Bachelor of Architecture, the Master of Architecture, and the Doctor of Architecture. A program may be granted a 6-year, 3-year, or 2-year term of accreditation, depending on the extent of its conformance with established educational standards. Doctor of Architecture and Master of Architecture degree programs may consist of a pre-professional undergraduate degree and a professional graduate degree that, when earned sequentially, constitute an accredited professional education. However, the pre-professional degree is not, by itself, recognized as an

accredited degree." (Excerpt from NAAB Conditions for Accreditation, 2009 Edition).

The M.S. in Architecture program is a research-focused degree program designed to offer students graduate level research inquiry into architecture for students who hold a professional baccalaureate or graduate degree in architecture.

The Ph.D. in Architecture program is a research-focused degree program for students with a research-focused master's degree who have previously studied the technical and professional aspects of architectural or landscape architectural practice and are primarily interested in strengthening the intellectual underpinnings of their work through significant and original theoretical inquiry.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Master of architecture (M.Arch.)

The applicant's baccalaureate degree may be in a field other than architecture or be a non-professional baccalaureate degree in architecture. This M.Arch. program culminates in a professional degree, accredited by the National Architectural Accrediting Board (NAAB).

A minimum grade-point average [GPA] of 3.0 on a 4.0 scale is required.

All applicants for admission to the M.Arch. degree program must submit the following:

- a completed Graduate School application (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>), and payment of the non-refundable application fee
- official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>)
- names of three faculty members or professionals acquainted with the applicant's academic history who can be contacted and invited to provide reference letters
- a statement of intent, which should be primarily a description of the applicant's professional goals, subjects of study, and the area(s) of anticipated architectural inquiry
- a portfolio of creative and design work executed at the undergraduate level, under professional guidance or independently, provided that such work can be evidenced as executed by the applicant, is an important part of the graduate application. A minimum portfolio representation of one project for each year of academic undergraduate study, or its equivalent, is required
- other evidence of academic excellence, such as awards, design and scholarly achievements, and other recognitions that the applicant wishes to have considered by the admissions committee

Master of Science (M.S.)

All applicants must hold either (1) a professionally accredited baccalaureate degree in architecture or related field from a regionally accredited U.S. institution or (2) a tertiary (postsecondary) degree that is deemed comparable to a professionally accredited bachelor's degree in architecture or related field from a regionally accredited U.S.

institution; this degree must be from an officially recognized degree-granting institution in the country in which it operates. Alternatively, the applicant can hold (3) a baccalaureate degree from a regionally accredited U.S. institution plus a professionally accredited master's degree in architecture or related field or (4) a tertiary (postsecondary) degree that is deemed comparable to a bachelor's degree from a regionally accredited U.S. institution plus a professionally accredited master's degree in architecture or related field. These degrees must be from officially recognized degree-granting institutions in the country in which they operate.

A minimum grade-point average [GPA] of 3.0 on a 4.0 scale is required.

All applicants for admission to the M.S. in Architecture degree program must submit the following:

- a completed Graduate School application (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>), and payment of the non-refundable application fee
- official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>).
- names of three faculty members or professionals acquainted with the applicant's academic history who can be contacted and invited to provide reference letters
- a statement of intent, which should be primarily a description of the applicant's professional goals, subjects of study, and the area(s) of anticipated architectural inquiry
- a portfolio of creative and design work executed at the undergraduate level, under professional guidance or independently, provided that such work can be evidenced as executed by the applicant, is an important part of the graduate application. A minimum portfolio representation of one project for each year of academic undergraduate study, or its equivalent, is required
- other evidence of academic excellence, such as awards, design and scholarly achievements, and other recognitions that the applicant wishes to have considered by the admissions committee

Doctor of Philosophy (Ph.D.)

All applicants must hold either (1) a professionally accredited baccalaureate degree in architecture or landscape architecture from a regionally accredited U.S. institution and a master's degree in architecture or landscape architecture or related field or (2) a tertiary (postsecondary) degree that is deemed comparable to a professionally accredited bachelor's degree in architecture or landscape architecture from a regionally accredited U.S. institution and a master's degree in architecture or landscape architecture or related field; both degrees must be from an officially recognized degree-granting institution in the country in which they operate. Alternatively, the applicant can hold (3) a baccalaureate degree from a regionally accredited U.S. institution plus a professionally accredited master's degree in architecture or landscape architecture or (4) a tertiary (postsecondary) degree that is deemed comparable to a bachelor's degree from a regionally accredited U.S. institution plus a professionally accredited master's degree in architecture or landscape architecture; these degrees must be from officially recognized degree-granting institutions in the country in which they operate. Outstanding candidates who do not hold a professional architecture or landscape architecture degree but who satisfy all other entrance requirements may be admitted at the discretion of the program.

An overall minimum grade-point average of 3.20 for graduate and undergraduate degrees is required for admission. Exceptions to the

minimum 3.20 grade-point average may be made for students with special backgrounds, abilities, and interests at the discretion of the program.

All applicants for admission to the Ph.D. degree program must submit the following:

- a completed Graduate School application (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>) and payment of the application fee
- official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>)
- names of three faculty members or professionals acquainted with the applicant's academic history who can be contacted and invited to provide reference letters
- a Ph.D. Essay that (1) articulates the reasons for pursuing graduate training; (2) demonstrates that the Ph.D. program has been carefully considered and a relevant faculty member has been identified; (3) presents a clear research focus; and (4) highlights how previous education, academic background, and/or professional experience provide a foundation for pursuing graduate training in this research field
- a Curriculum Vitae
-

Degree Requirements Master of Architecture (M.Arch.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The professional M.Arch. may be completed in three years (seven semesters, with the fifth semester being a summer semester) of course work. The M.Arch. degree requires 40 credits of preparatory course work, plus 57 credits of core graduate course work for a total of 97 credits. Some or all of the preparatory course work may have been completed previously, in which case the total credits required for the degree may be reduced in an equivalent manner to a minimum of 57 credits of core courses. At least 36 credits must be at the 500 level, and at least 57 credits must be taken in residence at University Park. There will be a review of transcripts to assess the completion of materials covered in preparatory course work. Faculty will assess each accepted applicant's transcripts for possible course equivalents. If courses have been fulfilled with equivalent undergraduate or graduate course work, students will be eligible for advancement. Accordingly, time to complete degree requirements may be reduced.

The culminating experience of the M.Arch. degree is a master's design project, requiring the student to identify and formulate an area of inquiry and then to complete a research-intensive design project, documented in a volume that includes the design and the research. The capstone course ARCH 536 Design Inquiry is associated with this culminating experience, and students are required to complete two semesters of ARCH 536 for six credits each, for a total of 12 credits.

Code	Title	Credits
Preparatory Course Work		
AE 211		3
AE 421	Architectural Structural Systems I	3

AE 422	Architectural Structural Systems II	3
AE 424		3
ARCH 501	Analysis of Architectural Precedents: Ancient Industrial Revolution	3
ARCH 502	Analysis of Architectural Precedents: Modernism	3
ARCH 503	Materials and Building Construction I	3
ARCH 504	Materials and Building Construction II	3
ARCH 521	Visual Communications I	2
ARCH 522	Visual Communications II	2
ARCH 531	Architectural Design I	6
ARCH 532	Architecture Design II	6
Required Courses		
ARCH 451	Architectural Professional Practice	3
ARCH 480	Technical Systems Integration	3
Select 6 credits from the following:		6
ARCH 495	Advanced Architectural and Related Design/ Construction Work Experience II	
ARCH 496	Independent Studies	
ARCH 499	Foreign Studies	
ARCH 510	Contemporary Architecture and Planning Theories	3
ARCH 511	Theoretical Perspectives in Architecture	3
ARCH 519	Research in Architecture and Urban Design	3
ARCH 533	Architectural Design III	6
ARCH 534	Architectural Design IV	6
ARCH 550	Ethics in the Built Environment	3
Electives		
Select 9 credits		9
Culminating Experience		
ARCH 536	Design-Inquiry (Capstone Project)	12
Total Credits		97

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The culminating experience of the post-professional M.S. in Architecture program is a Master's Thesis, which requires the student to identify and formulate an area of inquiry within which he or she will be expected to do original research that tests a hypothesis, and to complete a written thesis that presents that research. The master's thesis committee must be composed of a minimum of three Graduate Faculty members, not less than two of whom shall be members of the Architecture Graduate Faculty. One of these two Graduate Faculty members shall serve as the chair of the committee and thesis adviser. One or more members of the committee may be members from another department.

At the master's thesis defense, the student presents a summary of her/his thesis. This presentation and part of the following discussion are open to the public. The thesis may only pass with a unanimous affirmative decision of the thesis committee. The graduate officer or department head must attend the thesis defense and sign off on the thesis; if the graduate officer is the adviser or a committee member then the department head must attend the defense and sign off on the thesis, and vice versa. The thesis must be accepted by the Graduate School.

The M.S. in Architecture is a 30-credit program that requires 24 credits of course work and 6 credits of thesis. At least 18 credits must be at the 500 or 600 levels, and at least 20 credits must be taken in residence at University Park.

Code	Title	Credits
Required Courses		
ARCH 511	Theoretical Perspectives in Architecture	3
ARCH 520	Methods of Inquiry in Architecture and Urban Design	3
ARCH 536	Design-Inquiry	6
ARCH 550	Ethics in the Built Environment	3
Electives		
Select 9 credits		9
Culminating Experience		
ARCH 600	Thesis Research	6
Total Credits		30

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Ph.D. degree requirements include successful completion of approved graduate course work, a qualifying examination, and English Competence requirements. For the Ph.D. degree, students must conduct significant original research that demonstrates mastery of the field. The student's program of courses is developed in cooperation with the student's Ph.D. committee. It is recommended that it consist of approximately 30 credits of course work, and must include ARCH 512A and ARCH 512B. This also includes 12 credits of course work for students without a research-focused master's degree in architecture or landscape architecture or related field (a research-focused master's degree is typically an M.S. in Architecture or Landscape Architecture degree, but can also be a post-professional M.Arch. or M.L.A. degree). There will be a review of transcripts to assess completion of materials covered in course work. A faculty review committee will assess each accepted applicant's transcripts for possible course equivalents.

At the conclusion of the student's course work, the Ph.D. student must pass a comprehensive examination that is developed and administered by the student's Ph.D. committee. To earn the Ph.D. degree, doctoral students must also write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School, and the student must pass a final oral examination (the dissertation defense).

Dual-Titles

Dual-Title M.S. and Ph.D. in Architecture and TRANSDISCIPLINARY RESEARCH ON ENVIRONMENT AND SOCIETY

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

The dual-title M.S. and Ph.D. in Architecture and Human Dimensions of Natural Resources and the Environment is a research-focused degree program that enables students from Architecture to acquire the

knowledge and skills of their major area of specialization in Architecture, while at the same time gaining the perspective and methods of Transdisciplinary Research on Environment and Society.

Admission Requirements

For admission to the dual-title degree under this program, a student must first apply and be admitted to Penn State's Graduate School as well as to the Architecture graduate program. Once enrolled in the Architecture program, the student can apply to the Admissions Committee of TREES. Doctoral students should enroll in a dual-title graduate degree program early in their training, and no later than the end of the fourth semester (not counting summer semesters) of entry into the graduate major program. Refer to the Admission Requirements section of the TREES Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/transdisciplinary-research-environment-society/>).

Degree Requirements for the Dual-title M.S.

To qualify for a dual-title degree, students must satisfy the requirements of the Architecture program in which they are primarily enrolled. In addition, they must satisfy the degree requirements for the dual-title M.S. in TREES, listed on the TREES Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/transdisciplinary-research-environment-society/>).

Upon a student's acceptance by the TREES admissions committee, the student will be assigned a TREES academic adviser in consultation with the TREES chair. As students develop specific scholarly interests, they may request that a different TREES faculty member serve as their adviser. The student and adviser will discuss a program of study that is appropriate for the student's professional objectives and that is in accord with the policies of Graduate Council, the Architecture program and the TREES Program.

Some courses may satisfy both the graduate major program requirements and those of the dual-title program. Final course selection, including which courses will satisfy the both the graduate major program and dual-title program requirements, is determined by the students with approval by their dual-title program advisers and their major program advisers.

A thesis committee for the dual-title M.S. degree will consist of two Graduate Faculty members from Architecture and one Graduate Faculty member from the TREES Program. The thesis topic itself will be an integration of both Architecture and TREES.

Candidates for the dual-title Master of Science degree in Architecture and TREES will also be required to pass a final defense covering the general field of Architecture and TREES Program, with emphasis on the student's area of specialization. The defense is to be administered by the student's thesis committee. The thesis may only pass with a unanimous affirmative decision of the thesis committee.

Degree Requirements for the Dual-title Ph.D.

To qualify for a dual-title degree, students must satisfy the requirements of the Architecture program in which they are primarily enrolled. In addition, they must satisfy the degree requirements for the dual-title Ph.D. in TREES, listed on the TREES Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/transdisciplinary-research-environment-society/>).

Upon a student's acceptance by the TREES admissions committee, the student will be assigned an TREES academic adviser in consultation with the TREES chair. As students develop specific scholarly interests, they may request that a different TREES faculty member serve as their

adviser. The student and adviser will discuss a program of study that is appropriate for the student's professional objectives and that is in accord with the policies of Graduate Council, the Architecture program and the TREES Program.

Particular courses may satisfy both the graduate major program requirements and those of the TREES program. If a TREES M.S. student continues into the TREES Ph.D. program, 15 credits of interdisciplinary course work must be selected, with the approval of the student's Ph.D. committee. Some courses may satisfy both the graduate major program requirements and those of the dual-title program. Final course selection, including which courses will satisfy the both the graduate major program and dual-title program requirements, is determined by the students with approval by their dual-title program advisers and their major program advisers.

The qualifying examination for Architecture will satisfy the qualifying exam requirement for the dual-title degree program in TREES. The Ph.D. committee must include at least one Graduate Faculty member from TREES. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. The TREES representative on the Ph.D. committee will participate in constructing and evaluating the comprehensive examination. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in TREES, the member of the committee representing TREES must be appointed as co-chair. All Ph.D. students will be required to complete, present, and defend a dissertation that incorporates a topic related to both their graduate major program and TREES.

All Ph.D. students will be required to complete, present, and defend a dissertation that incorporates a topic related to both Architecture and TREES. Candidates for the dual-title Ph.D. degree in Architecture and TREES will be required to pass a final oral examination (the dissertation defense) covering the general field of Architecture and TREES, with emphasis on the student's area of specialization. The defense is to be administered by the student's Ph.D. committee. A favorable vote of a two-thirds majority is necessary for passing. To earn the Ph.D. degree, doctoral students must also write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Integrated Undergrad-Grad Programs

Integrated B.Arch. in Architecture and M.S. in Architecture

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.Arch. in Architecture with the M.S. in Architecture offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- University Park

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The Integrated B.Arch./M.S. in Architecture program permits students to integrate the fifth year of the professional B.Arch. degree, pursued at Penn State, with the M.S. research degree into a continuous program of study culminating in the awarding of both degrees.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The Department of Architecture offers a limited number of academically superior students enrolled in the fourth year of the Bachelor of Architecture degree program the opportunity to enroll in an integrated program leading to both the B.Arch. and the M.S. in Architecture degrees. The ability to coordinate as well as concurrently pursue the two degree programs enables the student to achieve greater depth and comprehensiveness than if the degrees are pursued sequentially, and to earn the two degrees in a shorter period of time. In particular, the program encourages the student to integrate the undergraduate thesis design project with the master's thesis, thereby achieving a greater depth of inquiry. The number of openings to this special program is limited; admission is by invitation of the faculty and is extremely selective.

Students must apply to and meet the admission requirements of the Graduate School, as well as the graduate program in which they intend to receive their master's degree. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. Applicants to the integrated program must be enrolled in the fourth year of a B.Arch. program or otherwise qualified to apply for admission to the fifth year of the B.Arch. program at Penn State. To be admitted, applicants must have a minimum 3.20 junior/senior overall grade-point average (on a 4.0 scale) as well as (1) a minimum 3.20 GPA in architectural design courses (studio), and (2) a minimum 3.20 GPA in all course work except architectural design courses (studio).

All applicants for admission to the Integrated B.Arch./M.S. in Architecture degree program must submit the following:

- a completed Graduate School application (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>) and payment of the non-refundable application fee
- names of three faculty members or professionals acquainted with the applicant's academic history who can be contacted and invited to provide reference letters
- a statement of intent/plan of study, which should be primarily a description of the applicant's professional goals. The statement/plan shall clearly describe the student's proposed general thesis topic and a strategy for pursuing it, including a list of proposed courses and a list of faculty whom the student foresees as contributing to the course of study. The plan should be reviewed periodically with an adviser as the student advances through the program.
- a portfolio of creative and design work executed at the undergraduate level, under professional guidance or independently, provided that such work can be evidenced as executed by the applicant. A minimum portfolio representation of one project for each year of academic undergraduate study, or its equivalent, is required

The best-qualified students will be accepted up to the number of spaces available for new students.

Degree Requirements

Students must complete the requirements for both the B.Arch. and the M.S. in Architecture degrees with the exception that not more than 12 credits earned in either degree program may be used to meet the requirements of both degrees. Degree requirements for the Bachelor of Architecture are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). Degree requirements for the Master of Science in Architecture degree are listed on the Degree Requirements tab. A minimum of 50 percent of the courses proposed to count for both degrees must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
ARCH 451	Architectural Professional Practice	3
ARCH 511	Theoretical Perspectives in Architecture	3
ARCH 520	Methods of Inquiry in Architecture and Urban Design	3
ARCH 536	Design-Inquiry	1-12
ARCH 550	Ethics in the Built Environment	3

A minimum total of 180 credits are required to complete the Integrated B.Arch./M.S. in Architecture program and earn both degrees. The student must maintain a minimum 3.2 overall GPA and shall achieve no less than a B grade in each required course.

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.S. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)

- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

All applicants who are accepted are considered for departmental financial aid.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Architecture (ARCH) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/arch/>)

Professional Licensure/Certification

Many U.S. states and territories require professional licensure/certification to be employed. If you plan to pursue employment in a licensed profession after completing this program, please visit the Professional Licensure/Certification Disclosures by State (<https://www.psu.edu/state-licensure-disclosures/>) interactive map.

Contact

Campus	University Park
Graduate Program Head	Frank Richard Jacobus
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Ute Poerschke
Program Contact	Nina Diez Bumgarner 121 Stuckeman Family Building University Park PA 16802 ndb2@psu.edu (814) 865-0991
Program Website	View (http://stuckeman.psu.edu/arch/)

Art

Graduate Program Head	Vagner Mendonça-Whitehead
Program Code	ART
Campus(es)	University Park (M.F.A.)
Degrees Conferred	Master of Fine Arts (M.F.A.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=ART)

The Penn State School of Visual Arts offers the degree of Master of Fine Arts (M.F.A.) in Art, a 60-credit graduate program supporting artistic work, academic inquiry, and creative investigation in the areas of ceramics, drawing & painting, graphic design, new media, photography, and sculpture. While students situate themselves within one of these areas of concentration, the structure of the program encourages interplay between media and disciplines in support of each individual's graduate work.

Headed by a dedicated faculty of internationally acclaimed artists, the M.F.A. program is recognized for emphasizing excellence in the study of visual art and fostering artistic production that engages critically with contemporary culture. By creating a rigorous yet supportive environment in the context of a major public research university, the program encourages expansive growth and innovative collaboration in studio practice. The regular interaction between studio and classroom creates a close-knit intellectual community that furthers critical thinking and creative connectedness. As the transformative power of art in today's society continues to evolve, the Penn State School of Visual Arts encourages artists to address contemporary social and cultural issues through creative production.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The Master of Fine Arts program in art, with its emphasis on professional study, is designed for the mature individual who by previous training and study has sufficiently prepared for the undertaking. It is strongly suggested that applicants have a minimum of 12 credits of art history at the undergraduate level. Any qualified student holding a bachelor's degree from a U.S. regionally accredited institution or a postsecondary degree that is equivalent to a U.S. baccalaureate degree earned from an officially recognized degree-granting international institution may seek admission. The School of Visual Arts requires a minimum of 3.00 junior/senior grade-point average (on a 4.00 scale) for admission to the master of fine arts program. Exceptions to the minimum 3.00 average may be made for students with special backgrounds, abilities, and interests, at the discretion of the program.

In addition to the previous requirements, all applicants must submit:

1. A portfolio of his/her work to illustrate his/her preparation for graduate study. A portfolio of digital images, rather than actual work, is required. A selection of no fewer than twenty examples should be presented. The majority should be in the area of the applicant's interest.
2. A statement of professional aims. This statement should include the applicant's intentions for his/her proposed study. Some indications of his/her philosophy, beliefs, and goals in regard to education and art should give evidence that he/she is prepared to undertake the work outlined for the Master of Fine Arts program.
3. Three letters of reference attesting to the applicant's scholarship and ability to work independently.

Degree Requirements

Master of Fine Arts (M.F.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The School of Visual Arts requires a minimum total of 60 credits at the 400, 500, or 800 level, with a minimum of 24 credits at the 500 level, for the Master of Fine Arts degree. Not more than 10 credits may be transferred from other accredited graduate institutions, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>). Of the 60 credits required for graduation, candidates are expected to complete the following distribution of credits: 30 credits in a major area of concentration, 12 credits in art history and critical studies, 10 credits in related areas, and 8 credits in graduate seminar (ART 505).

In addition to course work, M.F.A. candidates must pass a candidacy review, which is usually held at the end of the second semester of study, submit an artist's statement, pass the M.F.A. comprehensive oral examination and produce an M.F.A. exhibition. The approval of the M.F.A. exhibition by a candidate's committee represents the culminating experience of the program.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by

graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Art (ART) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/art/>)

Contact

Campus	University Park
Graduate Program Head	Vagner Mendonca-Whitehead
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Thomas Arthur Lauerman
Program Contact	Rebecca Emily Glover 210 Patterson Building University Park PA 16802 reg5569@psu.edu (814) 863-5349
Program Website	View (http://sova.psu.edu/)

Art Education

Graduate Program Head	Karen Keifer-Boyd
Program Code	AED
Campus(es)	University Park (Ph.D., M.S.) World Campus (M.P.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Master of Professional Studies (M.P.S.) Dual-Title Ph.D. in Art Education and African American and Diaspora Studies Dual-Title Ph.D. and M.S. in Art Education and Women's, Gender, and Sexuality Studies
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=AED)

This program helps students prepare for careers in:

- College teaching
- Administration
- Research
- Public school art teaching
- Art supervision

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/>)

gcac-300/gcac-305-admission-requirements-international-students/) for more information.

Students who seek admission to the graduate program must make formal application to The Graduate School and admissions committee of the Art Education program. To be admitted without deficiencies, the student is expected to have completed either a baccalaureate degree in art education or a program considered by the admissions committee to provide an appropriate background for the application's degree objectives. Related programs include work in studio art, art history, art education, education, museum education, etc. Deficiencies may be made up by course work that is not counted as credit toward an advanced degree. Students pursuing graduate degrees may simultaneously take course work leading to teaching certification and art supervisory certification. The students who plan to teach art education at the college level should note that some institutions require professors to hold a public school art teaching certificate and to have had public school teaching experience.

Students with a minimum 3.00 junior/senior grade-point average (on a 4.00 scale) and with appropriate course backgrounds will be considered for admission. The most qualified applicants will be accepted up to the number of spaces that are available for new students. Exceptions to the minimum 3.00 average may be made for students with special backgrounds, abilities, and interests. Transcripts should indicate high attainment in appropriate academic and creative work. Letters of recommendation should attest to scholarship and ability to work independently. In addition to the above requirements, there are specific requirements for each degree program:

M.S. and Ph.D. Application Materials

1. Completed official Penn State Graduate School Application for Admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>).
2. Submit a one- to two-page Statement of Professional Intent which includes:
 - a. professional objectives
 - b. how these objectives would be furthered by graduate study,
 - c. the areas in which research and creative work are planned,
 - d. what the applicant hopes to do with the graduate degree he or she is seeking to attain, and
 - e. evidence that the applicant is prepared to undertake graduate level work.
3. Submit an example of scholarly writing.
4. Submit three (3) letters of recommendation. Letters of recommendation should attest to the applicant's scholarship and ability to work independently.
5. Submit official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>).
6. Submit a Portfolio (optional). Applicants may submit images of their creative works that represent arts-based research or images that illustrate their conception of art.
7. Indicate in your Statement of Professional Intent if you would like to be considered for an Assistantship/Fellowship.

M.P.S. Application Materials

1. Completed official Penn State Graduate School Application for Admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>).

2. Statement of purpose in pursuing the M.P.S. in Art Education.
3. Three letters of recommendation.
4. Teaching portfolio to include teaching philosophy and a sample of curricular materials developed by the applicant.
5. A critical reflective written response to an article provided in the GRADS application site. The response should outline the key arguments made by the author(s), a critical evaluation of the logic and assumptions in the article, and a connection to the applicant's own instructional or professional experience.
6. Curriculum vitae with evidence of professional leadership and service.
7. Official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>), including official military transcripts (if applicable). (All college or university transcripts are required regardless of the length of time that has passed, the grades earned, or the accreditation of the institutions attended.)
8. International applicants whose first language is not English or who have received a baccalaureate or master's degree from an institution in which the language of instruction is not English, please refer to GCAC-305 Admission Requirements for International Students (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/admission-requirements-international-students/>).

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Degree Requirements

Master of Professional Studies (M.P.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students who seek admission to the M.P.S. in Art Education program should have current or recent teaching positions in a school, museum, cultural institution, or other community site at the time of application, with the expectation that the student continue to teach art in schools, museum, or other sites throughout the M.P.S. program. M.P.S. in Art Education program participants can start in any semester, taking one online art education course and one or more foundation or elective courses in other programs per semester. Applicants admitted to the degree program who have accumulated credits as non-degree graduate students may be able to apply these credits towards the M.P.S. degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>).

For the M.P.S. in Art Education program, a minimum of 30 graduate credits is required. Students must complete 18 credits in 500-level courses and above, with a minimum of 6 credits at the 500-level. A minimum of 18 credits in art education includes the following Internet-based 3-credit courses:

Code	Title	Credits
Required Courses		
AED 811	New Media and Pedagogy	3
AED 812	Diversity, Visual Culture, and Pedagogy	3
AED 813	Public Pedagogy	3
AED 814	Informal Learning	3
AED 815	Action Research in Art Education	3

Electives

6 credits of Foundational courses at the 400, 500, or 800 level in art history, studio, philosophy, educational theory and policy, educational psychology, psychology, and/or anthropology	6
6 credits of electives	6

Culminating Experience

AED 594	Research Topics	3
Total Credits		30

AED 594 is the culminating experience for the program with an action research project in one's teaching context.

Master of science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A minimum of 30 credits at the 400, 500, 600, or 800 level is required, with least 18 credits at the 500 and 600 level, combined. Students must take a minimum of 15 credits in art education. M.S. candidates are expected to complete the following:

Code	Title	Credits
Required Courses		
AED 502	Research in Art Education	3
AED 505	Foundations of Art Education	3
AED 536 or AED 588	Curriculum Development in Art Education History of Art Education	3
AED 590	Colloquium (1 credit for each two semesters enrolled in course work)	2

Electives

6 credits of foundational studies at the 400, 500, or 800 level in areas such as art history, studio, philosophy, educational theory and policy, educational psychology, psychology, and anthropology	6
9 credits of electives	9

Culminating Experience

AED 600	Thesis Research	6
Total Credits		32

M.S. candidates must prepare and orally defend a thesis. Requirements include 6 credits of thesis research within the 30 credits.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Course Requirements

All doctoral students are expected to complete the following core courses:

Code	Title	Credits
Required Courses		
AED 502	Research in Art Education	3
AED 505	Foundations of Art Education	3
AED 536	Curriculum Development in Art Education	3
AED 588	History of Art Education	3

AED 590	Colloquium (1 credit for each two semesters enrolled in course work)	2
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Electives

6 additional credits in Art Education at the 400, 500, or 800 level	6
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Although not required by the program, Ph.D. students are strongly encouraged to complete a minor area of study. A foreign language is not required of Ph.D. candidates. Instead, the inquiry and foreign language requirement for the Ph.D. is met through 12 credits of graduate-level course work in a related discipline as determined by the student's committee.

qualifying examination

Once admitted to the doctoral program, all students must take a qualifying examination, which is given during the first year that the student is in residence. During the qualifying examination there is a review of

1. the student's professional resume;
2. a statement regarding the general direction of the student's research interests and possible areas of thesis inquiry;
3. completed graduate courses;
4. proposed course of study for subsequent semesters;
5. selected graduate papers written by the student;
6. slides or original work if studio inquiry is part of the student's program of study.

All Ph.D. students must complete at least 2 continuous semesters of residency after passing the qualifying examination.

English Competence

At or before the qualifying exam, all doctoral students are required to demonstrate high-level competence in the use of the English language, including reading, writing, and speaking, as part of the requirement for the doctoral program. Competency must be formally attested to by the student's committee before the comprehensive examination is held.

Comprehensive Examination

Ph.D. candidates are required to take a written and oral comprehensive examination once their course work is substantially completed. The examination, prepared by the student's Ph.D. committee, covers all phases of the student's doctoral work both inside and outside the field of art education.

Doctoral Dissertation

Ph.D. candidates are required to complete a dissertation on a topic of research approved by the student's Ph.D. committee. The dissertation must be defended before the academic community at a final oral examination. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School

Dual-Titles**Dual-Title Ph.D. in Art Education and African American and Diaspora Studies**

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Students must apply and be admitted to the graduate program in Art Education and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the African American and Diaspora Studies dual-title program. Refer to the Admission Requirements section of the African American and Diaspora Studies Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/african-american-diaspora-studies/>).

Doctoral students must be admitted into the dual-title degree program in African American and Diaspora Studies prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Art Education, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual-title in African American and Diaspora Studies, listed on the African American and Diaspora Studies Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/african-american-diaspora-studies/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Art Education and must include at least one Graduate Faculty member from the African American and Diaspora Studies program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role.

There will be a single qualifying examination, containing elements of both Art Education and African American and Diaspora Studies. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

Ph.D. Committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of an Art Education and African American and Diaspora Studies dual-title Ph.D. student must include at least one member of the African American and Diaspora Studies Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in African American and Diaspora Studies, the member of the committee representing African American and Diaspora Studies must be appointed as co-chair.

Comprehensive Exams

The African American and Diaspora Studies Graduate Faculty member on the student's committee is responsible for developing and administering the African American and Diaspora Studies portion of the student's comprehensive exams. The exam must incorporate written and oral components in African American and Diaspora Studies based on the student's research interest and specialization in African American and Diaspora Studies. The African American and Diaspora Studies portion of the exam may address one or more of the following components: broad history of the field, contemporary theory and debates, and either sexual and gender politics or a topic related to the student's specific area of interest.

Dissertation

The candidate must complete a dissertation and pass a final oral defense of that dissertation on a topic that reflects their original research and

education in both Art Education and African American and Diaspora Studies in order to earn the dual-title PhD degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title M.S. and Ph.D. in Art Education and Women's, Gender, and Sexuality Studies

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admissions Requirements

Students must apply and be admitted to the graduate program in Art Education and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Women's, Gender, and Sexuality Studies dual-title program. Refer to the Admission Requirements section of the Women's, Gender, and Sexuality Studies Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/womens-gender-sexuality-studies/>). Doctoral students must be admitted into the dual-title degree program in Women's, Gender, and Sexuality Studies prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Art Education, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual-title in Women's, Gender, and Sexuality Studies, listed on the Women's, Gender, and Sexuality Studies Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/womens-gender-sexuality-studies/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Art Education and must include at least one Graduate Faculty member from the Women's, Gender, and Sexuality Studies. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Art Education and Women's, Gender, and Sexuality Studies. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of an Art Education and Women's, Gender, and Sexuality Studies dual-title Ph.D. student must include at least two members of the Women's, Gender, and Sexuality Studies Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Women's, Gender, and Sexuality Studies, the member of the committee representing Women's, Gender, and Sexuality Studies must be appointed as co-chair. The Women's, Gender, and Sexuality Studies representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education

in Art Education and Women's, Gender, and Sexuality Studies. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Art Education (AED) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/aed/>)

Contact

Campus	University Park
Graduate Program Head	Karen Treat Keifer-Boyd
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Aaron D Knochel
Program Contact	Rebecca Emily Glover 210 Patterson Building University Park PA 16802 reg5569@psu.edu (814) 863-5349
Program Website	View (https://arts.psu.edu/degrees/master-of-science-in-art-education/)
Campus	World Campus
Graduate Program Head	Karen Treat Keifer-Boyd
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Karen Treat Keifer-Boyd
Program Contact	Tracie L Mehalick 207 Arts Cottage University park PA 16802 t1m250@psu.edu (814) 863-7589
Program Website	View (https://www.worldcampus.psu.edu/degrees-and-certificates/art-education-masters/overview/)

Art History

Graduate Program Head	Robin Thomas
Program Code	ARTH
Campus(es)	University Park (Ph.D., M.A.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Arts (M.A.) Dual-Title Ph.D. in Art History and Asian Studies Dual-Title Ph.D. in Art History and Visual Studies
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=ARTH)

A graduate degree in art history prepares students for careers as scholars and educators, as museum curators, as public advocates of cultural heritage, and as arts administrators, to name just a few of the professions that recent program alumni have entered. Breadth of knowledge is as essential for museum professionals as it is for academic researchers. For this reason, advanced study of the visual arts and material culture from diverse periods and geographies is required of all graduate students, with Ph.D. candidates attaining deep expertise in at least one field of art historical research. The department's faculty includes specialists in African, Asian, and European art and the arts of the Americas.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to

Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Applicants with a 3.00 junior/senior grade-point average and a minimum of 21 credits in art history will be considered for admission to the master's program. Lacking these, a promising applicant may be provisionally admitted (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/provisional-admission/>) on condition that deficiencies be remedied, but without graduate degree credit. Applicants to the Ph.D. program must have an M.A. in art history or a closely related field. The best-qualified applicants will be accepted up to the number of spaces that are available for new students. GRE scores will not be accepted.

Degree Requirements

Master of arts (M.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Students in the M.A. degree program are required to complete a minimum total of 36 credits at the 400, 500, 600, or 800 level, with least 18 credits at the 500 and 600 level, combined (including a master's thesis or paper). Students choosing to complete a thesis must complete at least 6 credits in thesis research (ARTH 600 or ARTH 610). Students choosing to complete a scholarly paper must complete at least 18 credits in 500-level courses.

Code	Title	Credits
Required Courses		
ARTH 551	Historiography of Art History (taken during one's first fall semester)	3
27 credits at the 400 or 500 level, of which 3 credits must be taken in three of the following four areas: ¹		27
(1) Africa and the Middle East		
(2) The Americas		
(3) Asia and the Pacific		
(4) Europe and the Mediterranean		
Culminating Experience		
ARTH 600	Thesis Research ²	6
or ARTH 596	Individual Studies	
Total Credits		36

¹ Nine ARTH credits must be at the 500 level (ARTH 551 and ARTH 596 may not be used to fulfill this requirement).

² 6 credits of ARTH 600 for a master's thesis or 6 credits of ARTH 596 for a master's paper. ARTH 596 may be used only by a master's candidate for a master's paper. The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School.

In addition, students must demonstrate a reading proficiency in one foreign language. A reading competency in one foreign language must be demonstrated before the end of one year of study. The foreign language must be relevant to the student's areas of study and will be determined through consultation with the student's faculty adviser, subject to the approval of the Graduate Officer. A master's examination

must also be passed by all students before completing the M.A. degree. The master's examination is not a thesis defense.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Eighteen credits, not including doctoral dissertation research, are required for the Ph.D. At least 12 of these credits must be in art history. ARTH 560 Methods of Research in Art History (3 cr.) is required. At least 12 of the art history credits must be at the 500 level (ARTH 596 cannot be used to fulfill this requirement). At the discretion of the student's Ph.D. committee, the student may be required to take additional specialized courses pertaining to their major area of study. A reading competency in two foreign languages must be demonstrated before the end of one year of study. The two foreign languages must be relevant to the student's areas of study and will be determined through consultation with the student's faculty adviser, subject to the approval of the Graduate Officer. For the Ph.D., a qualifying examination, a comprehensive examination, and a final oral examination must be successfully completed in addition to the student's doctoral dissertation. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Titles

Dual-Title Ph.D. in Art History and Asian Studies

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Graduate students with research and educational interests in Asian Studies may apply to the Art History/Asian Studies dual-title program. The goal of the dual-title degree in Art History and Asian Studies is to enable graduate students from Art History to acquire the knowledge and skills of their major area of specialization in Art History while at the same time gaining the interdisciplinary perspective of Asian Studies.

In order to prepare graduate students for the competitive job market, this program provides them with a solid disciplinary foundation that will allow them to compete for the best jobs in their field. For such students the dual-title Ph.D. in Asian Studies will add value to their degree and their status as candidates. It will produce excellent historians who are experts in Asian Studies as well. The dual-title degree Art History and Asian Studies will build curricular bridges beyond the student's major field so as to provide a unique training regime for the global scholar.

Admission Requirements

For admission to the dual-title Ph.D. degree under this program, a student must first apply and be admitted to the Art History graduate program. Once accepted into the Art History program, the student can apply to the Admissions Committee of the Asian Studies during the first two semesters of study and before the qualifying examination. The Asian Studies admissions committee reviews applications and recommends students for admission to the Asian Studies program to the Graduate School. Refer to the Admission Requirements section of the Asian Studies Bulletin page. (<http://bulletins.psu.edu/graduate/programs/majors/asian-studies/>) Applicants interested in the program should make that known clearly on their applications and include remarks in their essays that explain their training, interests, and career goals in an area of Asian Studies. Doctoral students must be admitted into the

dual-title degree program in Asian Studies prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for an Asian Studies degree, students must satisfy the requirements of the Art History program in which they are primarily enrolled. In addition, students must complete the degree requirements for the dual-title in Asian Studies, listed on the Asian Studies Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/asian-studies/>). Within this framework, final course selection is determined by the student, their Asian Studies adviser, and their Art History program adviser.

Upon a student's acceptance by the Asian Studies admissions committee, the student will be assigned an Asian Studies academic adviser in consultation with the Asian Studies chair. As students develop specific scholarly interests, they may request that a different Asian Studies Graduate Faculty member serve as their adviser. The student and advisor will discuss a program of study that is appropriate for the student's professional objectives and that is in accord with the policies of The Graduate School, the Art History department and the Asian Studies program.

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Art History and must include at least one Graduate Faculty member from the Asian Studies program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Art History and Asian Studies. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of an Art History and Asian Studies dual-title Ph.D. student must include at least one member of the Asian Studies Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Asian Studies, the member of the committee representing Asian Studies must be appointed as co-chair. The Asian Studies representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Art History and Asian Studies. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title Ph.D. in Art History and Visual Studies

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Students must apply and be admitted to the graduate program in Art History and the Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Visual Studies dual-title program. Refer to the Admission Requirements section of the Visual Studies Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/visual-studies/>). Doctoral students must be admitted into the dual-title degree program in Visual Studies prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the Ph.D. in Art History. In addition, students must complete the degree requirements for the dual-title in Visual Studies, listed on the Visual Studies Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/visual-studies/>).

Qualifying Examination

The dual-title field will be fully integrated into the qualifying exam for the doctoral program. The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Art History and must include at least one Graduate Faculty member from the Visual Studies program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. In addition, students in the dual-title Ph.D. in Visual Studies will be required to present to their committee a portfolio of work in Visual Studies, including a statement of the student's interdisciplinary research interests, a program plan, and samples of writing that indicate the student's interest in questions related to the Visual Studies.

Because students must first be admitted to a graduate major program of study before they may apply to and be considered for admission into a dual-title graduate degree program, dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

Ph.D. committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of an Art History and Visual Studies dual-title Ph.D. student must include at least one member of the Visual Studies Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the committee chair does not represent Visual Studies, the committee member representing Visual Studies must be appointed as co-chair.

Comprehensive Exam

The Visual Studies Graduate Faculty member on the student's committee is responsible for developing and administering the Visual Studies portion of the student's comprehensive exam. The exam must incorporate components addressing Visual Studies based on the student's areas of interest and specialization in the Visual Studies.

Dissertation

The candidate must complete a dissertation on a topic that reflects his or her original research and education in both Art History and in Visual Studies in order to earn the dual-title Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate

program, and the Graduate School, and the student must pass a final oral examination.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Art History (ARTH) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/arth/>)

Learning Outcomes

Master of Arts (M.A.)

1. **KNOW** - Graduates will demonstrate deep knowledge of two areas of art historical research, a primary area and a secondary area, and will demonstrate competency in a foreign language relevant to the primary area of research.
2. **APPLY/CREATE** - Graduates will be able to formulate a research plan, create an undergraduate art history course, and interpret works of art in a museum or other collection.
3. **COMMUNICATE** - Graduates will be able to convey ideas and research orally and in written form to peers, students, and the general public.
4. **THINK** - Graduates will be able to critique, analyze, and synthesize art historical scholarship in the primary and secondary areas and to

produce original conclusions based on research based on archival and other primary sources, including works of art.

5. **PROFESSIONAL PRACTICE** - Graduates will be effective at teaching and assessing students at the undergraduate level. Graduates will be aware of disciplinary standards for research and teaching.

Doctor of Philosophy (Ph.D.)

1. **KNOW** - Graduates will demonstrate expert knowledge of two areas of art historical research, a primary area and a secondary area, and will demonstrate competency in two foreign languages relevant to the primary area of research.
2. **APPLY/CREATE** - Graduates will be able to formulate an original research plan, develop undergraduate and graduate art history curricula, and interpret works of art in a museum or other collection.
3. **COMMUNICATE** - Graduates will be able to convey original ideas and research orally and in written form to peers, students, and the general public.
4. **THINK** - Graduates will be able to critique, analyze, and synthesize and art historical scholarship in the primary and secondary area and to produce extended arguments and original conclusions based on research based on archival and other primary sources, including works of art.
5. **PROFESSIONAL PRACTICE** - Graduates will be effective at teaching and assessing students at the undergraduate and graduate level, prepared to serve as peer review for scholarly publications, and able to advocate persuasively for the value of the interpretation, presentation, and preservation of the visual arts. Graduates will be aware of disciplinary standards for research and teaching.

Contact

Campus	University Park
Graduate Program Head	Robin Thomas
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Nancy Elizabeth Locke
Program Contact	Erica Lynn Nodell Art History 240 Borland Building University Park PA 16802 exn30@psu.edu (814) 865-4873
Program Website	View (http://www.arthistory.psu.edu/)

Artificial Intelligence

Graduate Program Head	Raghu Sangwan
Program Code	AI
Campus(es)	World Campus (M.P.S.)
Degrees Conferred	Master of Professional Studies (M.P.S.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=AI)

The MPS in Artificial Intelligence (MPS-AI) degree is a 33-credit online, interdisciplinary master's program that aims to prepare students to drive the design, development, and deployment of AI and machine learning (ML) products and services across a broad array of application domains to meet contemporary social and technical challenges. Graduates will

work in positions that require them to identify and acquire datasets and design and prototype AI systems utilizing data mining, deep learning, neural networks, and collective intelligence using state-of-the-art toolsets and platforms.

Admissions Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Admission to the M.P.S. in Artificial Intelligence program will be based on baccalaureate academic records, applicable work experience, and two letters of recommendation from a previous professor or supervisor who can attest to the applicant's academic potential. Applicants with undergraduate degree in a computer science, engineering or mathematics may apply. Students from other disciplines will be considered based on prior coursework (including the Entrance Requirements for Mathematics and Programming stated below) and standardized test scores. Applications must include a statement of professional goals, a curriculum vita or resume, and two letters of recommendation. An undergraduate cumulative grade-point average of 3.0 or better on a 4.0 scale in the final two years of undergraduate studies is required.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Entrance Requirement regarding Mathematics: Applicants must complete Calculus I equivalent to Penn State University's MATH 140 and one semester of probability or statistics.

Entrance Requirement regarding Programming: Applicants must complete two introductory-level programming courses where both courses used the same language. If an applicant believes his/her work experience satisfy the background, he/she should include a recommendation letter from a technical colleague describing the applicant's coding contributions at work.

Degree Requirements

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The MPS-AI degree is conferred upon students who earn a minimum of 33 credits at the 400, 500, or 800 level while maintaining an average grade-point average of 3.0 or better in all course work, including at least 18 credits at the 500 level or 800 level (with at least 6 credits at the 500 level). The program curriculum includes 21 credits of required courses, 9 credits of electives, and a 3-credit capstone course.

Code	Title	Credits
Required Courses		
STAT 500	Applied Statistics	3
DAAN 570	Deep Learning	3
DAAN 862	Analytics Programming in Python	3

A-I 879	Machine Vision	3
A-I 574	Natural Language Processing	3
A-I 801	Foundation of Artificial Intelligence	3
STS 589	Ethics and Values in Science and Technology	3

Electives

An additional 9 credits of elective courses must be selected from the approved list of elective courses maintained by the graduate program office.

Culminating Experience

A-I 894	Capstone Experience	3
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Total Credits

33

Culminating Experience

All students will complete their program of study with the 3-credit capstone course (A-I 894) that provides students with an opportunity to apply their knowledge of the theories, methods, processes, and tools of AI, learned throughout their program, in a culminating and summative experience. The choice of project topic and exact form will be mutually determined by the instructor and each student. A written paper based on the applied project is required and must contain project description, analysis, and interpretation of its findings. Students will be encouraged to upload their capstone work products to be available publicly via ScholarSphere (<https://scholarsphere.psu.edu/>) and to participate in the World Campus Graduate Capstone Exhibition.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate

student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

The specific learning objectives of the MPS-AI program are to teach students to achieve proficiency in the following areas:

- **KNOW:** Graduates will be able to demonstrate appropriate breadth and depth of interdisciplinary knowledge, and comprehension of the major issues in artificial intelligence and machine learning.
- **APPLY/CREATE:** Graduates will be able to acquire relevant datasets and identify and develop appropriate AI/ML algorithms to solve contemporary challenges.
- **COMMUNICATE:** Effectively communicate the major issues of artificial intelligence and its applications including theories, approaches, findings, and implications both technical and ethical.
- **THINK:** Graduates will be able to discriminate between state-of-the-art techniques in neural network architecture, machine learning, deep learning, and collective intelligence to determine the appropriate approach for a given problem.
- **PROFESSIONAL PRACTICE:** Know and conduct themselves in accordance with the highest ethical standards, values, and, where these are defined, the best practices of the (as expressed in SARI training modules).

Contact

Campus	World Campus
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Youakim Badr
Program Contact	Sharon V. Patterson Penn State Great Valley 30 E. Swedesford Rd. Malvern PA 19355 svp40@psu.edu (610) 648-3318
Program Website	View (https://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-artificial-intelligence-masters-degree/overview/)

Asian Studies

Graduate Program Head	Erica Brindley
Program Code	ASIA
Campus(es)	University Park
Degrees Conferred	Dual-Title
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=ASIA)

Students electing this program through their primary graduate programs will earn a Ph.D. in (graduate program name) and Asian Studies. The following graduate programs offer dual-title degrees in Asian Studies: Applied Linguistics, Art History, Comparative Literature, History, and Political Science.

The primary objective of the dual-title degree program in Asian Studies is to engage critically and substantively with the teaching, research, and scholarship of Asia, a diverse area with a population of some 4.5 billion. The program integrates knowledge and methodology across disciplines through partnerships with the departments of History, Political Science, Comparative Literature, and Applied. Graduate students are trained in such a way that they are equipped to represent, understand, analyze, and appraise the crucial and current scholarly issues in Asian Studies in the context of their disciplinary foci. The program aims to produce doctoral graduates with a competitive advantage for employment that relates to Asia in academia and other professional fields.

Admission Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Students must apply and be admitted to their primary graduate program and The Graduate School before they can apply for admission to the Asian Studies dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Asian Studies dual-title program. Doctoral students must be admitted into the dual-title degree program in Asian Studies prior to taking the qualifying examination in their primary graduate program.

Applicants should have a junior/senior cumulative average of a 3.00 (on a 4.00 scale) and appropriate course background. Prospective students seeking admission to the dual-title degree program will write a statement of purpose that addresses the ways in which their research and professional goals will reflect an interest in interdisciplinary and Asian Studies-related research.

Degree Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

To qualify for a dual-title degree, students must satisfy the requirements of the primary graduate program in which they are enrolled. In addition, they must satisfy the degree requirements for the dual-title in Asian Studies, listed below. The requirements for the dual-title Ph.D. include Asia-related coursework, Asia-related components to the qualifying and comprehensive exams, strong all-skills proficiency in one Asian language and either two-years' college study (or equivalent) of another Asian language or else an alternative proficiency appropriate to the student's field; and the completion of an Asian Studies-related dissertation.

Course work: 15 credits of Asia-related coursework at the 400 or 500 level. At least 9 of these 15 credits will be from ASIA 501 and ASIA 502, and (depending on students' home department's requirements) ad hoc 597 seminars on individual topics. The remainder of the credits may come from Asian Studies or from the student's primary graduate program, as approved by the student's doctoral adviser and the Asian Studies program director of graduate studies.

Language requirement: Students will show strong all-skills proficiency in one Asian language and either two years' college study (or equivalent) of another Asian language or else an alternative proficiency appropriate to the student's field.

The qualifying examination committee for the dual-title Ph.D. degree must include at least one Graduate Faculty member from the Asian Studies program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both the primary graduate degree program and Asian Studies. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of an Asian Studies dual-title doctoral degree student must include at least one member of the Asian Studies Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Asian Studies, the member of the committee representing Asian Studies must be appointed as co-chair. The Asian Studies representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in both their primary graduate program and Asian Studies. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/>)

gsad/gsad-900/gsad-901-graduate-assistants/) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Asian Studies (ASIA) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/asia/>)

Learning Outcomes

1. **Knowledge about Asia.** Graduates will demonstrate (a) an integrated understanding of the history of and current developments in theories and methods of studying Asia, (b) the ability to use such theories and methods in their research and/or practice, and (c) substantial knowledge concerning their area of specialization concerning Asia.
2. **Critical Thinking.** Graduates will demonstrate (a) critical thinking skills in the evaluation and critique of research in their specific area of specialization, (b) the ability to identify questions and solve issues in scholarly and professional environments, and (c) competence in formulating one's own scholarly opinions based on the integration of knowledge from diverse sources
3. **Communication.** Graduates will demonstrate the ability to (a) communicate effectively in scholarly and professional environments, (b) defend their ideas to others in research and practice, and (c) disseminate their knowledge and skills to enhance awareness to groups beyond their areas of specialization
4. **Research Skills.** Students will demonstrate the ability to (a) critically analyze and integrate diverse research findings (b) systematically identify and frame research questions, design a research question, analyze the resulting data, and draw appropriate and interesting conclusions that contribute to current scholarly debates in their fields, and (c) organize their findings in written format, and/or present the findings in academic presentations or professional meetings
5. **Diversity and Ethical Considerations.** Students will demonstrate (a) an awareness of, and ability to work professionally with diverse individuals, groups, and communities, who represent various cultural and personal backgrounds and characteristics, (b) knowledge and application of ethical principles related to the responsible conduct of research, as well as to professional activities with individuals, groups, and organizations

Contact

Campus	University Park
Graduate Program Head	Erica Fox Brindley
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Ran Zwigenberg
Program Contact	William Whitesmith 438 Burrowes Building University Park PA 16802 wmw5235@psu.edu (814) 863-3522
Program Website	View (http://asian.la.psu.edu/)

Astrobiology

Graduate Program Head	Bradford Foley
Program Code	ABIOL
Campus(es)	University Park
Degrees Conferred	Dual-Title
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=ABIOL)

Students electing this degree program through participating programs earn a degree with a dual-title in the Ph.D., i.e., Ph.D. in (graduate program name) and Astrobiology. The following graduate programs offer dual-title degrees in Astrobiology:

- Astronomy and Astrophysics
- Biochemistry, Microbiology, and Molecular Biology
- Chemistry
- Geosciences
- Meteorology & Atmospheric Science

Astrobiology is a field devoted to the exploration of life outside of Earth and to the investigation of the origin and early evolution of life on Earth. This dual-title program enables students from several graduate programs to gain the perspectives, techniques, and methodologies of Astrobiology, while maintaining a close association with their primary graduate program.

Admission Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Students must apply and be admitted to their primary graduate program and The Graduate School before they can apply for admission to the Astrobiology dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Astrobiology dual-title program. Doctoral students must be admitted into the dual-title degree program in Astrobiology no later than the end of the fourth semester (not counting summer semesters) of entry into the graduate major program.

To apply for the Astrobiology dual-title, graduate students must submit transcripts of their undergraduate and graduate course work, a written personal statement indicating the career goals they hope to serve by attaining an Astrobiology dual title, and a statement of support from their dissertation adviser (or, if an adviser has not yet been chosen, from the Head of the student's graduate program). A strong undergraduate preparation in the basic sciences is expected, with evidence of an interest in multiple disciplines.

Degree Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

To qualify for a dual-title degree, students must satisfy the requirements of the major graduate program in which they are enrolled, in addition to the minimum requirements of the Astrobiology program. The

minimum requirements for the Astrobiology program include 3 credits of coursework in each of five different areas, specified as follows:

Code	Title	Credits
Required Courses		
	3 credits of 500-level coursework related to the origin and evolution of life on Earth (GEOSC 502 Evolution of the Biosphere, or approved substitute)	3
	3 credits of 500-level coursework related to planetary formation, evolution, and exploration (ABIOL 574 Planetary Habitability, or approved substitute)	3
	3 credits of 500-level coursework related to the astronomical search for life (ABIOL 576/ASTRO 576 The Search for Extraterrestrial Intelligence, ASTRO 577 Exoplanets, or approved substitute)	3
	3 credits of ABIOL 590 Astrobiology seminar. The seminar course may include fieldwork, when such an option is offered.	3
	3 credits of 400, 500, or 800 level, astrobiology-related coursework in field outside the student's major or 3 credits of 500-level coursework within their major (through consultation with their adviser). A list of pre-approved courses is available from the Program Coordinator; other courses must be approved by him/her.	3
Total Credits		15

The Qualifying Examination in the major area alone will satisfy the Qualifying Exam requirement for the dual-title program.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of an Astrobiology dual-title doctoral degree student must include at least one member of the Astrobiology Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Astrobiology, the member of the committee representing Astrobiology must be appointed as co-chair. The Astrobiology representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in both their primary graduate program and Astrobiology. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)

- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Astrobiology (ABIOL) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/abiol/>)

Learning Outcomes

1. **KNOW:** Students will develop and demonstrate advanced knowledge of a sub-specialty of geosciences, including understanding of, for example, historical and cutting-edge concepts, approaches, and techniques used in the field.
2. **ANALYZE & CREATE:** Students will demonstrate the ability to independently conceive a research hypothesis or question, and to contextualize the results of data collection and analysis.
3. **RESEARCH IMPLEMENTATION:** Students will demonstrate the ability to develop and implement scientific approaches, utilizing data collection, analysis, or numerical models, to address a question or hypothesis.
4. **COMMUNICATE:** Students will develop the ability to communicate their research findings to an audience of their peers in both written and oral form.
5. **QUANTIFY:** Students will develop the ability to incorporate quantitative analysis of data to support interpretations.
6. **CRITICAL THINKING:** Graduates will be able to critically analyze and assess work by others in their field of specialty.
7. **PROFESSIONAL PRACTICE:** Students will demonstrate knowledge of ethical standards in research and scholarship, and the ability to collaborate in a collegial and ethical manner with other professionals within their field or with diverse scientific backgrounds.

Contact

Campus	University Park
Graduate Program Head	Bradford James Foley
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Bradford James Foley
Program Contact	507 Deike Building University Park PA 16802
Program Website	View (https://www.ems.psu.edu/academics/find-program-study/astrobiology-phddual-title/)

Astronomy and Astrophysics

Graduate Program Head	Rebekah Dawson
Program Code	ASTRO
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Dual-Title Ph.D. in Astronomy and Astrophysics and Astrobiology
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=ASTRO)

The graduate program in Astronomy and Astrophysics prepares students for careers in astronomy, space science and education. Graduate instruction and research opportunities are available in theoretical, observational, and instrumental astronomy and astrophysics. Currently active areas of theoretical research include high-energy astrophysics (including theory of neutron stars, black holes, and gamma ray bursts), relativity and cosmology, stellar dynamics and planet formation, and computational methodology. Observational areas include spectroscopic and photometric observations of high-redshift quasars, galaxies and the intergalactic medium; gamma-ray bursts; X-ray and visible light studies of quasars, starburst and other active galaxies; visible light studies of nearby galaxies and their stellar populations; infrared study of brown dwarfs and protoplanetary disks; spectroscopy and modeling of binary, magnetically active, pre- and post-main sequence stars; spectroscopic searches for planetary systems. Instrumental areas include: development of X-ray telescopes and detectors; and high-precision visible and near-infrared light spectrographs. Department faculty members participate in several university cross-disciplinary organizations: Astrobiology Research Center, Center for Astrostatistics, Center for Exoplanets and Habitable Worlds, and the Institute for Gravitation and the Cosmos.

The department played a seminal role in and leads many science investigations using two NASA-launched satellites, the Chandra X-ray Observatory and the Swift panchromatic gamma-ray burst mission, and the innovative 9-meter Hobby-Eberly Telescope located at the McDonald Observatory in Texas. Faculty and students also observe with other space-based observatories (GALEX, Hubble Space Telescope, Spitzer Space Telescope, XMM-Newton) and ground-based telescopes (Gemini and other national facilities, Magellan, Keck, South Africa Large Telescope, Very Large Telescopes). Physics faculty members closely associated with the Department are involved in particle and gravitational wave observations using the Auger, AMANDA, Ice Cube, and LIGO instruments. The Department has extensive computing facilities, and

research is also conducted with university and national supercomputing resources.

Graduate students also have ample opportunity to acquire experience in undergraduate teaching and public outreach.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Normally, students admitted to the program are required to have a bachelor's degree in physics and/or astronomy with a grade-point average of at least 3.0 in their junior/senior courses in physics, astronomy, math, and related subjects. GRE scores are not accepted.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Applicants to the Astronomy and Astrophysics program must have a minimum TOEFL score of 590 on the paper-based test, or a total score of 96 with a 23 on the speaking section for the Internet-based test (iBT).

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The Master of Science degree requires completion of the Ph.D. course requirements (except the 3 credits of ASTRO 589) with 3.00 grade point average, passage of the qualifying exam, and submission of an acceptable scholarly paper, completed while enrolled in ASTRO 596.

Code	Title	Credits
Required Courses		
<i>10 3-credit courses, including:</i>		
ASTRO 501	Fundamental Astronomy	3
ASTRO 502	Fundamental Astrophysics	3
at least 4 additional ASTRO 500-level courses		12
4 additional 3-credit courses ¹		12
<i>In addition, the following courses are required:</i>		
ASTRO 590	Colloquium	1
ASTRO 602	Supervised Experience in College Teaching ²	1
Culminating Experience		
ASTRO 596	Individual Studies ³	3
Total Credits		34

¹ The remaining courses may be chosen from 500-level offerings in any of the following fields: Astronomy & Astrophysics, Physics, Statistics, Mathematics, Applied Mathematics, Biology, Chemistry, Astrobiology, Geosciences, Meteorology, Materials Science and Engineering, Computer Science, or one of the Engineering or Information Science and Technology disciplines. One 400-level class may be substituted for

a course that is not one of the ASTRO 500-level courses. A GPA of 3.2 in the ten 3-credit courses is required.

² Credits for ASTRO 602 cannot be counted towards the minimum credits required for the degree.

³ M.S. students must submit an acceptable scholarly paper, completed while enrolled in ASTRO 596.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A minimum of 37 credits is required for the Ph.D., including:

Code	Title	Credits
Required Courses		
<i>A GPA of 3.2 in the following ten 3-credit courses is required:</i>		
ASTRO 501	Fundamental Astronomy	3
ASTRO 502	Fundamental Astrophysics	3
at least 4 additional ASTRO 500-level courses		12
4 additional 3-credit courses ¹		12
<i>In addition, the following courses are required:</i>		
ASTRO 589	Seminar in Current Astronomical Research	3
ASTRO 590	Colloquium	1
ASTRO 596	Individual Studies ²	3
ASTRO 602	Supervised Experience in College Teaching ³	1
Total Credits		37

¹ The remaining courses may be chosen from 500-level offerings in any of the following fields: Astronomy & Astrophysics, Physics, Statistics, Mathematics, Applied Mathematics, Biology, Chemistry, Astrobiology, Geosciences, Meteorology, Materials Science and Engineering, Computer Science, or one of the Engineering or Information Science and Technology disciplines. One 400-level class may be substituted for a course that is not one of the ASTRO 500-level courses. A GPA of 3.2 in the ten 3-credit courses is required.

² For directed research in the second year.

³ Credits for ASTRO 602 cannot be counted towards the minimum credits required for the degree.

The qualifying examination is an oral examination covering any area of astronomy. Students who fail the examination may make a second attempt. At the Comprehensive Examination, the student presents a significant body of original research conducted at Penn State. This Examination tests the student's mastery of the chosen field of research. The student prepares an extended written report and oral presentation, and answers questions on the research and closely related areas. Graduation requires the completion of a dissertation of original research and a final oral examination (the dissertation defense). To earn the Ph.D. degree, doctoral candidates must write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Titles

Dual-Title Ph.D. in Astronomy and Astrophysics and Astrobiology

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://>

gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/).

Admissions Requirements

Students must apply and be admitted to the graduate program in Astronomy and Astrophysics and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Astrobiology dual-title program. Refer to the Admission Requirements section of the Astrobiology Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/astrobiology/>). Doctoral students must be admitted into the dual-title degree program in Astrobiology no later than the end of the fourth semester (not counting summer semesters) of entry into the graduate major program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the Ph.D. in Astronomy and Astrophysics, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual-title in Astrobiology, listed on the Astrobiology Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/astrobiology/>).

The Qualifying Examination in the major area alone will satisfy the Qualifying Exam requirement for the dual-title program.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of an Astronomy and Astrophysics and Astrobiology dual-title Ph.D. student must include at least one member of the Astrobiology Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Astrobiology, the member of the committee representing Astrobiology must be appointed as co-chair. The Astrobiology representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Astronomy and Astrophysics and Astrobiology. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)

- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Graduate Teaching Assistantships, externally funded graduate Research Assistantships, and/or University fellowships are typically provided to student admitted and continuing in good standing. Many students also apply for externally funded fellowships.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Astronomy and Astrophysics (ASTRO) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/astro/>)

Learning Outcomes

Master of Science (M.S.)

1. Know/Think/Apply: Graduates will have demonstrated command of basic observational astronomy and astrophysics, including observing techniques, methods of data analysis, and common theoretical frameworks and techniques. This will include the ability to apply physics and mathematics knowledge to standard problems in astrophysics, as well as application of statistical principles to data analysis.
2. Communicate: Graduates will be able to clearly and cogently describe the background and motivation of their work, describe their methodology, and present and defend their arguments and conclusions in oral presentations, written papers and reports.
3. Ethical Professional Conduct: Graduates will demonstrate working knowledge of the standards for ethical conduct in research through their professional behavior and work.

Doctor of Philosophy (Ph.D.)

1. Know/Think: Graduates will have demonstrated command of basic observational astronomy and astrophysics, including observing techniques, methods of data analysis, and common theoretical frameworks and techniques. This will include the ability to apply physics

and mathematics knowledge to standard problems in astrophysics, as well as application of statistical principles to data analysis.

2. **Apply/Think/Create:** Graduates will be able to carry out original research in theoretical astrophysics, observational astronomy, or laboratory astrophysics (including but not limited to instrumentation development). This entails identifying and evaluating the status of outstanding questions, developing strategies to answer them, and formulating hypotheses and testing them through one or more of the following means: calculations or simulations, model development, analysis of existing data, acquisition and analysis of new data, and design and/or construction of new instruments.
3. **Communicate:** Graduates will be able to clearly and cogently describe the background and motivation of their research, describe their research methodology, and present and defend their arguments and conclusions in oral presentations, written papers and reports, and, where applicable, proposals.
4. **Ethical Professional Conduct:** Graduates will demonstrate working knowledge of the standards for ethical conduct in research through their professional behavior and work.

Contact

Campus	University Park
Graduate Program Head	Rebekah Ilene Dawson
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Randy McEntaffer
Program Contact	Amanda Igyarto 525 Davey Laboratory University Park PA 16802 aki5136@psu.edu (814) 865-0419
Program Website	View (https://science.psu.edu/astro/)

Athletic Training

Graduate Program Head	Nancy Williams
Program Code	ATHTR
Campus(es)	University Park (M.A.T.)
Degrees Conferred	Master of Athletic Training (M.A.T.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=facprog=ATHTR)

The Master of Athletic Training degree delivers a person-centered curriculum designed to provide learners with cutting-edge knowledge and skills necessary to excel as a versatile health care provider in diverse practice settings. Through an integrative framework that promotes evidence-informed decision-making, inter-professional collaboration, and cultural competence, students develop attitudes and habits that cultivate career enrichment and meaningful lifelong learning. As an accredited program, educational experiences are structured to prepare candidates to successfully achieve standards set forth by the national Board of Certification and related state regulatory agencies required to practice.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to

Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

For admission to the Athletic Training program, applicants must hold a bachelor's degree (or equivalent) from a US regionally accredited institution or international equivalent. An undergraduate major in the health sciences is preferred but this is not a mandatory requirement. For admissions consideration, an applicant should ordinarily have an overall cumulative grade-point average (GPA) of at least 3.0 and an overall science GPA of at least 3.0 (based on a 4-point scale).

Several prerequisites and foundational knowledge (Standards 54 and 55 (<https://caate.net/wp-content/uploads/2018/09/2020-Standards-for-Professional-Programs-copiedited-clean.pdf>)) are required for admission consideration. Listed below are the subjects and corresponding number of credits applicants must complete before enrollment. For applicants on a trimester schedule, 5-to-6 quarter hours at minimum satisfy a prerequisite.

- Anatomy and Physiology (including labs): 6-to-8 credits
- Biomechanics: 3 credits
- Chemistry (including lab): 3-to-4 credits
- English Composition or Intensive Writing: 3 credits
- Exercise Physiology: 3 credits
- General Biology (including lab): 3-to-4 credits
- Nutrition: 3 credits
- Physics (including lab): 3-to-4 credits
- Psychology: 3 credits
- Statistics: 3 credits

A minimum letter-grade of C is required in each course linked to this list. Furthermore, coursework in these subjects have a five-year currency. This currency requirement may potentially be waived for an applicant who has been working full time and continuously in the health care field since completing the coursework. Although completion of coursework is not required until the time of enrollment, no more than two courses specifically linked to this prerequisite list can be outstanding at the time of application.

Advanced placement credit accepted at an undergraduate institution can satisfy a number of prerequisites including biology, chemistry, psychology, statistics, and English composition courses. College-Level Examination Program credit may also satisfy course prerequisites. Any course that an undergraduate institution deems as having satisfied a "writing intensive" requirement will suffice. This course can be in any major and does not need to be an English major-based course. Additionally, if an applicant's bachelor's degree incorporates writing across the curriculum, they should share this information with the admissions committee.

Optional preparation through coursework in the areas listed below is strongly recommended.

- Basic Emergency Care (1-4 credits)
- Medical Terminology (1-4 credits)

Applicants must hold current credentialing in emergency cardiovascular care. This requirement may only be satisfied with certification through one of the following programs:

- Basic Life Support (<https://cpr.heart.org/en/cpr-courses-and-kits/healthcare-professional/basic-life-support-bls-training/>) by the American Heart Association
- Basic Life Support for Healthcare Providers (<https://www.redcross.org/take-a-class/bls-training/bls-for-healthcare-providers/>) by the American Red Cross
- CPR for Healthcare Providers (<https://www.redcross.org/take-a-class/cpr/cpr-training/cpr-for-healthcare-providers/>) by the American Red Cross

Scores from the most recent standardized exam(s) an applicant has completed within the last five years. At the discretion of the program, this requirement may be satisfied through one or a combination of the following: Scholastic Aptitude Test (SAT), American College Test (ACT), and/or Graduate Record Examination (GRE).

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Applicants must demonstrate evidence of adequate exposure to the field of athletic training and understanding for the depth, breadth, and scope of practice through shadowing or volunteer experiences in various practice settings. A minimum of 50 hours is required with at least 25 hours being completed in a college/university setting and at least 25 hours in a secondary school or other non-college/university setting. Demonstration of an appreciation for the diverse patient populations athletic trainers interact with is highly preferred. Prospective students must have completed a minimum of 35 shadowing hours at the time of submitting their ATCAS application.

A personal statement must accompany application materials and include why an applicant is pursuing the degree program with focus on how their background and interests match well with the curriculum. Applicants should also preset a brief summary of short- and long-term goals relevant to career planning.

Three letters of recommendation are required for review. One letter from each of the following individuals is necessary:

- An athletic trainer the applicant interacted with during their shadowing or volunteer experience
- A faculty member from the applicant's college/university studies
- A supervisor/employer, preferably from a health care related experience/job

The letters should address the applicant's academic, professional, and personal attributes as well as potential for successful graduate study.

Selected candidates will be required to meet with the admissions panel for a personal interview. The panel looks for attributes such as maturity, empathy and compassion, motivation, ability to communicate, cultural sensitivity, critical thinking skills, and potential to achieve career fulfillment as an athletic trainer. Interviews may be conducted in-person or remotely, and provide an opportunity for candidates and the panel to interact. Discussion will center on how the program's mission and applicant's goals align. Additional dialogue will include rationale for entering the profession and pursuing a degree at Penn State.

Applicants offered admission to the Master of Athletic Training program must review the technical standards deemed essential for successful completion of the curriculum. Prior to and every semester after enrollment, students are required to attest that they meet the technical standards either with or without reasonable accommodations. Upon completion of the attestation, Penn State reserves the right not to admit any applicant who cannot meet the technical standards. This right to not admit or the right to rescind admission applies in cases where reasonable accommodation cannot be provided, would result in a fundamental alteration to the technical standards, or would compromise patient/client care or the safety of the prospective and/or currently enrolled students.

In addition to these admission requirements, participating clinical education sites (on- and off-campus) may require specific background checks and/or medical clearances in order to host a student for experiential learning purposes. Examples include screening of state or federal criminal records and vaccination records. Sites may choose to deny a student's placement in their facilities based on the information in these records. Such instances may create a barrier for students to satisfy compulsory clinical education activities and therefore not complete degree requirements necessary for graduation.

Degree Requirements

Master of Athletic Training (M.A.T.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The Master of Athletic Training (MAT) degree requires a minimum of 77 credits completed over 22 compulsory courses through a prescribed academic plan. At least six credits must be at the 500-level. A minimum of 71 credits are at the 800-level with at least three of these 800-level credits dedicated to a capstone project, which satisfies the culminating experience requirement. A minimum letter grade of C is required in each of the 22 compulsory courses. Students may earn additional credits through optional elective coursework.

A minimum of 1,395 clinical education hours are required for graduation.

Scholarship and Research Integrity requirements are satisfied through Collaborative Institutional Training Initiative trainings on Responsible Conduct of Research and Human Subjects Research.

Code	Title	Credits
Required Courses		
<i>Athletic Training Core Courses</i>		
ATHTR 500	Theory and Application of Evidence-Based Practice	3
ATHTR 501	Science and Ethics of Human Performance Optimization	3
ATHTR 800	Foundations of Clinical Practice I	4
ATHTR 801	Principles of Acute Care and Emergency Response	4
ATHTR 802	Anatomical Basis of Musculoskeletal Injury	4
ATHTR 803	Foundations of Clinical Practice II	4
ATHTR 804	Evaluation and Treatment of the Lower Extremities	4
ATHTR 805	Experiential Learning I	2
ATHTR 806	Evaluation and Treatment of the Upper Extremities	4
ATHTR 807	Clinical Interventions and Implementation: General Treatment Strategies	4
ATHTR 808	Therapeutic Interventions: Approaches and Techniques	4

ATHTR 809	Experiential Learning II	3
ATHTR 810	Evaluation and Treatment of the Spine and Thoracic Cage	4
ATHTR 811	Experiential Learning III	2
ATHTR 813	Administrative and Professional Aspects of Health Care	3
ATHTR 814	Experiential Learning IV	6
ATHTR 815	Seminars in Sports Health Care	3
ATHTR 816	Experiential Learning V	6
<i>Inter-Professional Education and Practice Courses</i>		
PHS 809	Principles of Public Health	3
NURS 802	Advanced Health Assessment of Adult Populations	3
NURS 802A	Advanced Health Assessment of Pediatric Populations	1
<i>Electives (optional and not required)</i>		
ATHTR 812	Elective Clerkship (optional and not required)	1-6
<i>Culminating Experience</i>		
ATHTR 817	Creative Knowledge Translation	3
Total Credits		77

Students in the MAT degree program are required to complete a capstone project as part of ATHTR 817. The project must demonstrate student aptitude for generating solutions to real-world challenges or problems in clinical, academic or administrative affairs linked to the profession. A final product of the capstone project must be submitted to ScholarSphere (<https://scholarsphere.psu.edu/>).

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up

deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

ATHTR Course List (p. 911)

Contact

Campus	University Park
Graduate Program Head	Nancy Williams
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Giampietro Luciano Vairo
Program Contact	Melissa Kay Weaver mkf15@psu.edu (814) 863-0442
Program Website	View (https://hhd.psu.edu/kines/graduate/master-athletic-training/)

Biobehavioral Health

Graduate Program Head	Thomas Gould
Program Code	BBH
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Dual-Title Ph.D. in Biobehavioral Health and Bioethics Dual-Title Ph.D. in Biobehavioral Health and Clinical and Translational Sciences Dual-Title Ph.D. in Biobehavioral Health and Social and Behavioral Neuroscience
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=BBH)

The graduate program in Biobehavioral Health (BBH) is an innovative, interdisciplinary graduate program within the College of Health and Human Development. The focus of the program is on the intersection of biological, psychological, behavioral, social, environmental, and cultural influences on health and disease throughout the lifespan. It is the fundamental principle of our department that an integrative approach to health research and health care holds the greatest potential to advance health. The program is designed to cultivate competence in basic, mechanistic, and applied research that addresses fundamental issues in health and prevention throughout the lifespan; we also provide training in the role of diversity and ethics in research, statistical and procedural research methods, and in university teaching. Graduates are prepared for research, teaching, or policy roles in academia (universities and medical schools), health care settings, private and public research laboratories, and government agencies.

There are special resources available to students in BBH that provide valuable training and support. Several are housed in BBH, including the Biomarker Core Lab and a specialized metabolic kitchen. BBH is also home to the Global Health Minor, which provides training in how to think critically about current public health challenges around the world. Furthermore, BBH is linked with many well-funded centers in the College, including the Prevention Research Center, the Methodology Center, the Center for Healthy Aging, the Clinical and Translational Science Institute, the Huck Institute of the Life Sciences, the Social Science Research

Institute, and the Social, Life, and Engineering Imaging Center. State-of-the-art library, teaching, and computing resources are provided by the College and University.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Scores from the Graduate Record Examinations (GRE) are optional. Choosing not to submit scores will not affect admissions decisions. When GRE scores are submitted, scores are considered as part of a holistic review process.

Applicants should have a minimum grade-point average of 3.00 (A=4.00) and three supporting recommendations. At the discretion of the graduate program, exceptions may be made to these requirements for students with special backgrounds, abilities, and interests. Admission will be offered to applicants who are the best qualified, in the judgment of the faculty, taking all factors in to account.

Entering students should have a basic background in biological sciences, the behavioral sciences, or a combination of the two. In addition, they should have a basic background in quantitative methods. In exceptional cases, superior students who do not meet these requirements may be admitted provisionally (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/provisional-admission/>), while correcting their deficiencies. This must occur during their first two semesters in the program.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

BBH does not offer a terminal Master's Degree. A minimum of 33 credits at the 400, 500, 600, or 800 level is required, with at least 18 credits at the 500 and 600 level, combined. All M.S. degree candidates must complete a formal master's thesis or a scholarly paper. Students selecting the thesis option must complete an additional 6 credits of master's thesis research (BBH 600). Students selecting the scholarly paper option must complete an additional 6 credits of individual studies (BBH 596) and at least 18 credits at the 500 level. The master's thesis will typically describe original research. The scholarly paper may describe original research, but may also involve a substantial review of the literature, or a substantial description of a new research-related procedure. The choice of thesis or scholarly paper options will be made by the student in consultation with the adviser. The student's advisory committee judges the quality and acceptability of the scholarly paper or thesis. In the case of the scholarly paper, the paper must be accepted by the advisers and/or committee members, and the head of the graduate program. In the case of the master's thesis, the paper must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School.

Code	Title	Credits
Required Courses		
BBH 501	Biobehavioral Systems in Health and Development: Theory and Processes	3
BBH 502	Health: Biobehavioral Perspectives	3
BBH 503	Biobehavioral Systems in Health and Development: Processes and Integration	3
BBH 504	Behavioral Health Intervention Strategies	3
BBH 505	Behavioral Health Research Strategies	3
12 additional credits in methods individually designed in consultation with and with the approval of their adviser and committee		12
Culminating Experience		
BBH 600 or BBH 596	Thesis Research Individual Studies	6
Total Credits		33

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

All doctoral students must take the following courses to develop doctoral-level competence in biobehavioral health and one or more related specialized areas:

Code	Title	Credits
Required Courses		
BBH 501	Biobehavioral Systems in Health and Development: Theory and Processes	3
BBH 502	Health: Biobehavioral Perspectives	3
BBH 503	Biobehavioral Systems in Health and Development: Processes and Integration	3
BBH 504	Behavioral Health Intervention Strategies	3
BBH 505	Behavioral Health Research Strategies	3
12 additional credits in research methods individually designed in consultation with the student's adviser and Ph.D. committee (and with approval of the PIC of the Graduate Program)		12
Total Credits		27

All doctoral students must demonstrate competency in college-level teaching by completing two semesters in the role of a teaching assistant; the professional development seminar provides support and mentoring to facilitate development of competency in college-level teaching.

Ph.D. degree requirements include successful completion of the following: approved graduate course work, English Competence requirements, a comprehensive examination, and a final oral examination (the dissertation defense). To earn the Ph.D. degree, doctoral candidates must write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Titles

Dual-Title Ph.D. in Biobehavioral Health and Bioethics

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Students must apply and be admitted to the graduate program in Biobehavioral Health and the Graduate School before they can apply for admission to the dual-title degree program in Bioethics. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Bioethics dual-title program. Refer to the Admissions Requirement section of the Bioethics Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/bioethics/>). Doctoral students must be admitted to the dual-title degree program in Bioethics prior to taking the qualifying exam in their primary graduate program.

Degree Requirements

Biobehavioral Health Ph.D. students may pursue additional training in bioethics through the dual-title Ph.D. program in Bioethics. To qualify for the dual-title degree, students must satisfy the requirements of the Biobehavioral Health Ph.D. program. In addition, students must complete the degree requirements for the dual-title in Bioethics, listed on the Bioethics Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/bioethics/>). Within this framework, final course selection is determined by the student, their Biobehavioral Health adviser, and their Bioethics program adviser.

Qualifying exam

In accordance with Graduate Council policy, there will be a single qualifying examination for both the primary program and the dual-title program. At least one member of the qualifying exam committee must come from the Bioethics program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed on semester beyond the normal period allowable.

Comprehensive exam

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Biobehavioral Health and Bioethics dual-title doctoral degree student must include at least one member of the Bioethics Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the committee is not also a member of the Graduate Faculty in Bioethics, the member of the committee representing Bioethics must be appointed as co-chair. The faculty member (or members) affiliated with the Bioethics Program will be responsible for administering a portion of the comprehensive exam that will require the student to demonstrate an understanding of various theoretical and methodological approaches to bioethics, and an ability to apply them to issues and problems (including, where appropriate, practical problems) in their primary field.

Dissertation and dissertation defense

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in BBH and Bioethics. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title Ph.D. in Biobehavioral Health and Clinical and Translational Sciences

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Doctoral students with research and educational interests in clinical and translational science may apply for the Dual-Title Ph.D. degree in Biobehavioral Health and Clinical and Translational Sciences following admission to the Graduate School and Biobehavioral Health graduate degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the CTS dual-title program. Refer to the Admissions Requirements section of the CTS Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/clinical-translational-sciences/>). Doctoral students must be admitted into the dual-title degree program in CTS prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

This dual-title degree program emphasizes interdisciplinary scholarship at the interface of basic sciences, clinical sciences, and human health. Students in the dual-title program are required to have two advisers from separate disciplines: one individual serving as the primary mentor in the graduate program in Biobehavioral Health and another individual serving as the secondary mentor in an area covered by the dual-title program who is a member of the Clinical and Translational Sciences faculty.

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in BBH, listed above. In addition, students must complete the degree requirements for the dual-title in CTS, listed on the CTS Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/clinical-translational-sciences/>).

In accordance with Graduate Council policy, the qualifying examination committee must include at least one member of the Clinical and Translational Sciences Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination which will include content from both the Graduate Program in Biobehavioral Health and the Clinical and Translational Sciences programs. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed on semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>), the Ph.D. committee must include at least one member of the Clinical and Translational Sciences Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the committee is not also a member of the Graduate Faculty in Clinical and Translational Sciences, the member of the committee representing Clinical and Translational Sciences must be appointed as co-chair. The fields of Biobehavioral Health and Clinical and Translational Sciences will be integrated in the student's comprehensive examination. The CTS representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

All students are required to conduct dissertation research that contributes fundamentally to the fields of Biobehavioral Health and Clinical and Translational Sciences. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title Ph.D. in Biobehavioral Health and Social and Behavioral Neuroscience

BBH doctoral students interested in having a degree that reflects interdisciplinary training in social and behavioral neuroscience as relevant to the domains of research expertise within BBH (e.g. integrating neuroscience techniques and perspectives to understanding integrative or interactive influences of biological, behavioral, psychological, sociocultural, and environmental variables on health across time scales and levels of analysis), may apply to pursue a dual-title Ph.D. in BBH and Social and Behavioral Neuroscience.

Social behavioral neuroscience reflects the study of how brain development and function influence, and are influenced by, social, environmental, and behavioral variables. The dual-title Ph.D. program provides students with additional training in an integrative neuroscience program in order to enable them to pursue innovative interdisciplinary research with intellectual sophistication.

Admission Requirements

Students must apply and be admitted to the graduate program in BBH and the Graduate School before they can be admitted to a dual-title degree program. Applicants interested in the dual-title degree program may note their interest in their applications to BBH. Students must apply and be admitted to the dual-title degree program in Social and Behavioral Neuroscience prior to taking the qualifying exam and must be in good standing in the BBH program. Students admitted to the BBH program will be admitted to the dual-title program in Social and Behavioral Neuroscience upon the recommendation of a Social and Behavioral Neuroscience Program faculty member in BBH. Doctoral students must be admitted into the dual-title degree program in Social and Behavioral Neuroscience no later than the end of the fourth semester (not counting summer semesters) of entry into the graduate major program.

Additional admissions requirements are listed in the Admissions Requirements section of the Social and Behavioral Neuroscience Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/social-behavioral-neuroscience/>).

Degree Requirements

To qualify for the dual-title degree, students must satisfy the requirements of the Ph.D. in BBH, listed above. In addition, students pursuing the dual-title Ph.D. in BBH and Social and Behavioral Neuroscience must complete the degree requirements for the dual-title Social and Behavioral Neuroscience Ph.D., listed on the Social and Behavioral Neuroscience Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/social-behavioral-neuroscience/>).

The Qualifying Examination requirement shall be satisfied by one of the following:

1. Ideally, a single Qualifying Examination that incorporates content from both Biobehavioral Health and Social and Behavioral Neuroscience is preferred. Dual-title degree students may request an additional semester to fulfill requirements for both areas of study and, therefore, the Qualifying Exam may be delayed one semester beyond

the normal period allowable. The Qualifying Examination committee for the dual-title degree will be composed of Graduate Faculty from BBH and must include at least one Graduate Faculty member from Social and Behavioral Neuroscience (SBN). Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. The chair of the qualifying examination committee must be a member of the Graduate Faculty and an affiliated member of the SBN program, or an affiliated member may be appointed as a co-chair. This requirement is more restrictive than the policy of the Graduate Council by decision of the BBH department.

- a. In cases where the timing of the Qualifying Examination in Biobehavioral Health precludes the inclusion of the dual-title, an examination demonstrating proficiency in Social and Behavioral Neuroscience may occur at a later time, but no later than the end of the fourth semester (not counting summer semesters) of entry into the major doctoral program. In cases where separate Qualifying Examinations are administered, Graduate Faculty from BBH will administer the BBH Qualifying Examination, and a separate SBN Qualifying Examination will occur by the end of the fourth semester that will be administered by a committee that will include at least two Graduate Faculty from BBH and at least one Graduate faculty from SBN.
2. With prior approval from the SBN Professor-in-Charge, the dual-title program in Social and Behavioral Neuroscience may allow the Qualifying Examination in Biobehavioral Health alone to satisfy the requirements for the dual-title program.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>), the Ph.D. committee of a dual-title doctoral degree student must include at least two members of the Social and Behavioral Neuroscience Graduate Faculty. This requirement is more restrictive than the policy of the Graduate Council by decision of the BBH department. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the committee representing BBH is not also a member of the Graduate Faculty in Social and Behavioral Neuroscience, the member of the committee representing Social and Behavioral Neuroscience must be appointed as co-chair. It is expected that the outside member of the Ph.D. committee serves as the second Social and Behavioral Neuroscience representative. Exceptions (e.g. having both Social and Behavioral Neuroscience committee members from within the home department) must be approved by the Social and Behavioral Neuroscience Steering committee. The Social and Behavioral Neuroscience representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Ph.D. candidates must complete a dissertation on a topic that reflects their original research and their education in both BBH and Social and Behavioral Neuroscience. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. In order to earn the dual-title Ph.D. degree, the dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School, and the student must pass a final oral examination (the dissertation defense).

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree

Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Biobehavioral Health (BBH) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/bbh/>)

Learning Outcomes

Master of Science (m.S.)

1. **KNOW** - Graduates will be able to demonstrate understanding of the literature regarding biological, psychological, sociocultural, ethical, behavioral, and environmental influences on various health outcomes and related phenomena.
2. **KNOW** - Graduates will be adequately proficient methodologically so as to comprehend the results of scientific literature encompassing these areas and to be able to conduct statistical analyses appropriately for their Master's paper or thesis if that paper or thesis includes empirical analyses.
3. **APPLY/CREATE** - Graduates will be able to review the relevant literature and generate ideas for novel research questions.
4. **COMMUNICATE** - Graduates will be able to write articles suitable for submission for publication in a peer reviewed journal.
5. **THINK** - Graduates will be able to think critically about research regarding biological, psychological, sociocultural, ethical, behavioral, and environmental influences on various health outcomes and relevant phenomena.

6. **PROFESSIONAL PRACTICE** - Graduates will demonstrate leadership, professionalism, and the highest ethical standards and values.

Doctor of Philosophy (Ph.D.)

1. **KNOW** - Graduates will be able to demonstrate mastery of the literature regarding biological, psychological, sociocultural, ethical, behavioral, and environmental influences on various health outcomes and related phenomena.
2. **KNOW** - Graduates will be methodologically proficient so as to comprehend (and contribute to) the results of a broad scientific literature encompassing these areas.
3. **APPLY/CREATE** - Graduates will be able to review the relevant literature and generate ideas for novel research questions.
4. **APPLY/CREATE** - Graduates will be able to design a research plan to answer novel research questions that move the field forward and carry it out to completion.
5. **COMMUNICATE** - Graduates will be able to write articles suitable for publication in top tier peer review journals.
6. **COMMUNICATE** - Graduates will be able to present the results of their research in a clear and concise manner to an audience in a professional society meeting.
7. **COMMUNICATE** - Graduates will be able to write research grant proposals to external funding agencies (e.g., NIH, NSF, or foundations).
8. **THINK** - Graduates will be able to think critically about research regarding biological, psychological, sociocultural, ethical, behavioral, and environmental influences on various health outcomes and relevant phenomena.
9. **PROFESSIONAL PRACTICE** - Graduates will demonstrate leadership, professionalism, and the highest ethical standards and values.
10. **PROFESSIONAL PRACTICE** - Graduates will be adequately prepared to apply for jobs in their field after graduating from our program.

Contact

Campus	University Park
Graduate Program Head	Thomas J Gould
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Jennifer Graham-Engeland
Program Contact	Shannon L Anthony 219 Biobehavioral Health Bldg. University Park PA 16802 sls9@psu.edu (814) 863-7424
Program Website	View (https://hhd.psu.edu/bbh/biobehavioral-health-graduate-program/)

Biochemistry, Microbiology, and Molecular Biology

Graduate Program Head	Santhosh Girirajan
Program Code	BMMB
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Dual-Title Ph.D. in Biochemistry, Microbiology, and Molecular Biology and Astrobiology Dual-Title Ph.D. in Biochemistry, Microbiology, and Molecular Biology and Biogeochemistry
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=BMMB)

The major goal of the program in Biochemistry, Microbiology, and Molecular Biology is to train students for independent research and teaching in the principal areas of those scientific disciplines. Students may enter the program from a variety of backgrounds such as biochemistry, biology, biophysics, cell biology, chemistry, genetics, microbiology, molecular biology, physics, and other related disciplines. The student's research may begin during the first year.

Research areas of faculty include:

- antibiotic discovery
- cell and developmental biology
- cell cycle control
- chromatin structure
- cryo-electron microscopy
- DNA binding proteins
- electron paramagnetic resonance spectroscopy
- enzymology
- genomics
- iron, lipid, cellulose and xenobiotic metabolism
- neurobiology
- metabolomics
- metallobiochemistry
- microbiology
- nuclear magnetic resonance spectroscopy
- parasitology
- pathogenesis
- photosynthesis
- plant biology
- proteomics
- regulation of gene expression
- RNA binding proteins
- RNA structure
- signal transduction
- transcriptomics
- virology
- X-ray crystallography

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Entering students should have taken courses in biology, biochemistry, chemistry, physics, genetics, and/or microbiology. Admission to the program is based on prior research experience, answers to program specific questions, course records and grades, letters of recommendation, and interviews.

All students are admitted with the intent of obtaining a Ph.D. degree, although a master's degree is obtained in some cases. The program does not admit for the terminal master's degree.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A minimum of 30 credits at the 400, 500, 600, or 800 level is required, with at least 18 credits at the 500 and 600 level, combined. Master's students must complete the following core courses in BMMB:

Code	Title	Credits
Required Courses		
BMMB 502	Critical Analysis of the Biochemical, Microbial, and Molecular Biology Scientific Literature	2
BMMB 801	Foundations of Teaching in Biochemistry, Microbiology, and Molecular Biology	1
BMMB 509	Ethics in Biomedical Science	1
BMMB 582	Advances in Genetics and Genomics	3
BMMB 581	Advances in Biochemistry	3
Culminating Experience		
BMMB 600	Thesis Research	6-15

Students are required to write a thesis, and at least 6 credits in thesis research (BMMB 600 or BMMB 610) must be taken in conjunction with completing the thesis. The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School, and the student must pass a thesis defense.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Each student must take a total of 19 credits in 400-, 500- and 800-level courses, required and elective, from a list approved by the program faculty. Doctoral students must complete the core courses in BMMB:

Code	Title	Credits
Required Courses		
BMMB 502	Critical Analysis of the Biochemical, Microbial, and Molecular Biology Scientific Literature	2
BMMB 509	Ethics in Biomedical Science	1

BMMB 581	Advances in Biochemistry	3
BMMB 582	Advances in Genetics and Genomics	3
BMMB 801	Foundations of Teaching in Biochemistry, Microbiology, and Molecular Biology	1

Additional course work and research are individually planned by the student and the research adviser in consultation with the Ph.D. committee. The Ph.D. committee is established in compliance with Graduate Council policy (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>) once the student has passed the qualifying examination.

Doctoral students must pass a qualifying examination, a comprehensive oral examination, and a final oral examination (the dissertation defense). Continuation in the Ph.D. program is decided on the basis of the student's performance in courses, research and teaching. In addition, an oral qualifying examination is taken during the fall semester of the second year. This examination tests the student's ability to utilize what they have learned in solving problems based on the scientific method. A comprehensive oral examination is taken before the student's Ph.D. committee within approximately three semesters after the student has passed the qualifying examination. The student is expected to present a written dissertation proposal including data that has been gathered, future research directions, and experimental approaches. Questioning may involve, but is not limited to, that dissertation proposal.

The faculty requires that each student demonstrate the ability to collect, organize, and present the results of their research in a professional manner before graduation. This is accomplished by preparing a manuscript based on the Ph.D. dissertation research. The manuscript must be written by the student and submitted for publication in a refereed journal prior to the final oral examination (the dissertation defense). The dissertation defense is taken before the student's Ph.D. committee at the end of the program. The student must also present a public seminar on the dissertation research within the two-week period preceding the dissertation defense. To earn the Ph.D. degree, the student's dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Other Relevant Information

The director of graduate studies is in charge of advising students about academic and related matters until they have chosen a dissertation adviser. Beginning students carry out a series of rotation projects in at least three different faculty laboratories before deciding on a research area. Students generally decide on their dissertation research adviser at the end of their first fall semester.

All students are required to participate as teaching assistants in undergraduate laboratory courses as part of their training. Students are required to register for BMMB 602 (Supervised Experience in College Teaching) for two semesters; however, these credits cannot be counted towards the minimum credits required for the degree.

Dual-Titles

Dual-Title Ph.D. Program in BIOCHEMISTRY, MICROBIOLOGY, AND MOLECULAR BIOLOGY and Astrobiology

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Graduate students with research and educational interests in astrobiology may apply to the Astrobiology Dual-Title Ph.D. Program. Students must apply and be admitted to the graduate program in BMMB and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Astrobiology dual-title program. Refer to the Admission Requirements section of the Astrobiology Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/astrobiology/>). Doctoral students must be admitted into the dual-title degree program in Astrobiology no later than the end of the fourth semester (not counting summer semesters) of entry into the graduate major program.

To qualify for the dual-title degree, students must satisfy the degree requirements for the Ph.D. degree in BMMB, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual-title in Astrobiology, listed on the Astrobiology Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/astrobiology/>).

The Qualifying Examination in the major area alone will satisfy the Qualifying Exam requirement for the dual-title program.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a BMMB and Astrobiology dual-title Ph.D. student must include at least one member of the Astrobiology Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Astrobiology, the member of the committee representing Astrobiology must be appointed as co-chair. The Astrobiology representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in BMMB and Astrobiology. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title Ph.D. Program in BIOCHEMISTRY, MICROBIOLOGY, AND MOLECULAR BIOLOGY and Biogeochemistry

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Graduate students with research and educational interests in biogeochemistry may apply to the Biogeochemistry Dual-Title Ph.D. Program. Students must apply and be admitted to the graduate program in BMMB and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Biogeochemistry dual-title program. Refer to the Admission Requirements section of the Biogeochemistry Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/biogeochemistry/>). Doctoral students must be admitted into the dual-title degree program

in Biogeochemistry prior to taking the qualifying examination in their primary graduate program.

Students in the Biogeochemistry Dual Title program are required to have two advisers from separate disciplines: one individual serving as a primary adviser in their major degree program and a secondary adviser in an area within a field covered by the dual-title program and a member of the Biogeochemistry faculty. To qualify for the dual-title degree, students must satisfy the degree requirements for the Ph.D. degree in BMMB, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual-title in Biogeochemistry, listed on the Biogeochemistry Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/biogeochemistry/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from BMMB and must include at least one Graduate Faculty member from the Biogeochemistry program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both BMMB and Biogeochemistry. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a BMMB and Biogeochemistry dual-title Ph.D. student must include at least one member of the Biogeochemistry Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Biogeochemistry, the member of the committee representing Biogeochemistry must be appointed as co-chair. The Biogeochemistry representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in BMMB and Biogeochemistry. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)

- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Biochemistry, Microbiology, and Molecular Biology (BMMB) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/bmmb/>)

Biological Chemistry (BCHEM) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/bchem/>)

Cell and Molecular Biology (CMBIO) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/cmbio/>)

Learning Outcomes

Master of Science (M.S.)

- Each student will be able to engage in a knowledgeable scientific conversation across BMMB topics.
- Each student will have detailed knowledge on the specific subject of their thesis research.
- Each student will be able to critically evaluate science and use the scientific method.
- Each student will have the skills to conduct experiments effectively, safely, and with high rigor and reproducibility.
- Each student will be prepared to work in a collaborative environment.
- Each student will be able to conduct research in an ethical manner and understand the impact of science on society.
- Each student will be able to communicate their work to scientists.
- Each student will demonstrate effective teaching strategies.
- Each student will have acquired the skills necessary to succeed in their chosen careers.

Doctor of Philosophy (Ph.D.)

- Each student will be able to engage in a knowledgeable scientific conversation across BMMB topics.
- Each student will be a world expert on the specific subject of their dissertation research.

- Each student will be able to critically evaluate science and use the scientific method.
- Each student will have the skills to conduct experiments effectively, safely, and with high rigor and reproducibility. These skills will be used to make a significant scientific contribution to the field of BMMB.
- Each student will be prepared to work in a collaborative environment to address cross-disciplinary questions.
- Each student will conduct research in an ethical manner and understand the impact of science on society.
- Each student will be able to communicate with experts in the field, non-expert scientists, and non-scientists.
- Each student will demonstrate effective teaching strategies.
- Each student will be able to lead a research endeavor.
- Each student will have acquired the skills necessary to succeed in their chosen careers.

Contact

Campus	University Park
Graduate Program Head	Santhosh Girirajan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Ying Gu
Program Contact	Kalysta Long 107 Althouse Laboratory University Park PA 16802 kjl5737@psu.edu (814) 865-2538
Program Website	View (https://science.psu.edu/bmb/graduate/)

Bioethics

Graduate Program Head	Jonathan H. Marks
Program Code	BIOET
Campus(es)	University Park
Degrees Conferred	Dual-Title
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=BIOET)

Students electing to pursue this program through participating departments will earn a degree with a dual-title at the Ph.D. level, i.e., a Ph.D. in (major program name) and Bioethics.

The following graduate programs offer dual-title Ph.D. degrees in Bioethics: Anthropology, Biobehavioral Health, Communication Arts and Sciences, Kinesiology, Nursing.

The Bioethics dual-title Ph.D. program is an intercollege program administered by the College of the Liberal Arts. The Bioethics Program Committee—which contains representatives from participating colleges and departments—periodically reviews the program's mission and goals, identifies faculty and courses relevant to the program, and recommends policies and procedures for the program's operation.

The dual-title Ph.D. degree in Bioethics fosters scholarly work across disciplines, increasing the intellectual rigor and breadth of graduate work through immersion in both Bioethics and the primary discipline. The dual-title degree provides opportunities for students to synthesize knowledge and develop expertise within and across disciplinary boundaries.

In addition to the intellectual and academic advantages of interdisciplinarity, the innovative dual-title Ph.D. program strengthens the reputation of collaborating programs/departments, increases recruitment of talented graduate students, and enhances students' competitiveness for job opportunities following graduation.

Admission Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Dual-title Bioethics graduate students will first be admitted to their major programs in accordance with the requirements stipulated by the Graduate Council and the major program. They will then be admitted to graduate study in the Bioethics program by an admissions committee consisting of faculty affiliated with the Bioethics program. Applicants should have a junior/senior cumulative average of at least 3.0 (on a 4.0 scale) and an appropriate background in undergraduate course work. Prospective dual-title students will write a statement of purpose that addresses the ways in which their research and professional goals reflect an interest in interdisciplinary bioethics research.

Degree Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

General requirements for the dual-title Ph.D. in Bioethics are:

- Required course work described below.
- Comprehensive examination in bioethics and the related field, with the format and content to be determined by agreement with the major department.
- Dissertation on a bioethics-related topic or that includes a substantial bioethics component.

Code	Title	Credits
Required Courses		
BIOET 501	Perspectives and Methods in Bioethics	3
BIOET 502	Perspectives in Macro-Bioethics	3
BIOET 590	Bioethics Colloquium	1
3 additional BIOET credits at the 500 level ¹		3
8 credits from a list of approved electives at the 400 and 500 level, with at least two credits at the 500 level ²		8
Total Credits		18

¹ With the approval of the Director of the Bioethics Graduate Program, students may also fulfill the requirement for the three additional 500-level BIOET credits through one of four alternatives:

- BIOET 590 (since the topics will vary from semester, students may take this course in subsequent semesters for additional credit)
- BIOET 594
- BIOET 596
- an additional elective course determined to satisfy this requirement on the grounds that the syllabus indicates a sufficiently strong bioethics content.

² Students in the program will take the remaining credits by choosing from a wide variety of existing elective courses at the 400 and 500 levels from a list maintained by the Director of the Bioethics Graduate Program in consultation with the Bioethics Program Committee. Students also have the right to petition the Director of the Bioethics Graduate Program to request that additional courses be added to the list of electives. The elective courses chosen by the student must be approved by either the Director of the Bioethics Graduate Program or, with the agreement of the Director, by another member of the Bioethics Program Committee. In addition, students may pursue an internship or practicum (BIOET 595), provided that this is approved in advance by the Director of the Bioethics Graduate Program.

Language Competency Requirements

The student will fulfill the language requirement specified by the major department through which the student is admitted to the dual-title degree program.

Qualifying Examination

The qualifying examination committee for the dual-title Ph.D. degree must include at least one Graduate Faculty member from the Bioethics program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both the primary graduate degree program and Bioethics. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

Committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Bioethics dual-title doctoral degree student must include at least one member of the Bioethics Graduate Faculty. Where major programs are supportive of this, graduate students will be encouraged to have a second committee member so qualified. Faculty members who hold appointments in both programs may serve in a combined role. If the committee chair does not serve in this combined role, the faculty member representing the Bioethics program must be designated as co-chair of the committee. The dual-title representative(s) will be expected to participate in constructing and grading comprehensive examination questions that cover the secondary area of study.

Comprehensive Exams

The faculty member (or members) affiliated with the Bioethics program will be responsible for administering a portion of the comprehensive exam that will require the student to demonstrate an understanding of various theoretical and methodological approaches to bioethics, and an ability to apply them to issues and problems (including, where appropriate, practical problems) in their major field.

Dissertation

A dissertation on a bioethics-related topic or with a substantial bioethics component is required of students in the dual-title Ph.D. program. The bioethics-related topic of the dissertation or the bioethics component will be approved by the student's committee. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must

be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Bioethics (BIOET) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/bioet/>)

Contact

Campus	University Park
Graduate Program Head	Jonathan Harold Marks
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Francisco Javier Lopez Frias
Program Contact	Jonathan Harold Marks jhm20@psu.edu (814) 865-5938

Biogeochemistry

Graduate Program Head	Mary Ann Bruns
Program Code	BGC
Campus(es)	University Park
Degrees Conferred	Dual-Title
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=BGC)

Students electing this degree program through participating programs earn a degree with a dual-title in the Ph.D., e.g., Ph.D. in (graduate program name) and Biogeochemistry.

The following graduate programs offer dual-title Ph.D. degrees in Biogeochemistry:

- Biochemistry, Microbiology, and Molecular Biology
- Chemistry
- Ecology
- Environmental Engineering (ENV_E)
- Geosciences
- Materials Science and Engineering
- Plant Pathology
- Soil Science

The Biogeochemistry dual-title degree program is administered by the Department of Geosciences with support from the Department of Ecosystem Science and Management for the participating graduate programs. A program committee with representatives from participating departments maintains program definition, identifies courses appropriate to the program, and recommends policy and procedures for the program's operation to the dean of the Graduate School and to the deans of the participating colleges.

The dual-title degree program is offered through participating programs in the College of Earth and Mineral Sciences, College of Agricultural Sciences, College of Engineering, Eberly College of Science, and the Intercollege Graduate Degree Programs.

The program enables students from several graduate programs to gain the perspectives, techniques, and methodologies of Biogeochemistry, while maintaining a close association with major program areas of study.

Admission Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Graduate students with research and educational interests in biogeochemistry may apply to the Biogeochemistry dual-title degree program. For admission to pursue a dual-title degree under this program, a student must apply to (1) the Graduate School and (2) one of the participating major graduate programs; and then subsequently to (3) the Biogeochemistry program committee. Students may only apply to the dual-title program once they have been accepted into a major program. Once a student has been accepted to a major program, application to the dual-title degree program can occur immediately or at a later time, such as upon matriculation. The application to the dual-title degree program,

however, must be accepted before the qualifying examination in the major program is scheduled.

Candidates must submit transcripts of their undergraduate and graduate course work, a written personal statement indicating their interests in the interdisciplinary area of Biogeochemistry and the career goals they hope to serve by attaining a Biogeochemistry dual-title, and a statement of support from their dissertation adviser, if assigned. A strong undergraduate preparation in the basic sciences is expected, with evidence of an interest in multiple disciplines.

Degree Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

To qualify for a dual-title degree, students must satisfy the requirements of the major graduate program in which they are enrolled, in addition to the minimum requirements of the Biogeochemistry program. Students are required to have two advisers from separate disciplines: one individual serving as a primary adviser in their major degree program (i.e., Soil Science, BMMB, Material Science & Engineering, Chemistry, Ecology, Environmental Engineering, Geosciences, or Plant Pathology) and a secondary adviser in an area within a field covered by the dual-title program who is a member of the Biogeochemistry Graduate Faculty. The major program adviser normally will also be a member of the Biogeochemistry Graduate Faculty. The two faculty advisers can represent different academic programs, but this is not required, as faculty from a scientifically diverse department could represent very different areas of expertise.

To fulfill the course requirements for the dual-title in Biogeochemistry, students must complete a total of 15 graduate credits chosen in consultation with the adviser from an approved list of courses in the areas of:

- biochemistry and microbiology,
- environmental chemistry,
- environmental engineering,
- geochemistry,
- materials science and engineering,
- and soil science.

All students must pass a qualifying examination that includes an assessment of their potential in the field of biogeochemistry. In all cases, the result of a single qualifying exam for both entrance to the student's major Ph.D. program and this dual-title program will be reported to the Graduate School. The qualifying examination committee must include at least one member of the Biogeochemistry Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. Because students must first be admitted to a graduate major program of study before they may apply to and be considered for admission into a dual-title graduate degree program, dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

The student's Ph.D. committee must include at least one member of the Biogeochemistry Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve

in a combined role. If the chair of the committee representing the student's major degree program is not also a member of the Graduate Faculty in Biogeochemistry, the member of the committee representing Biogeochemistry must be appointed as co-chair. The field of Biogeochemistry must be integrated into the comprehensive examination.

A Ph.D. dissertation that contributes fundamentally to the field of Biogeochemistry is required. A public oral presentation of the dissertation is required, which may be part of the final defense within the major degree program.

Ph.D. candidates must complete a dissertation on a topic that contributes fundamentally to the fields of both the student's major degree program and Biogeochemistry. In order to earn the dual-title Ph.D. degree, the dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School, and the student must pass a final oral examination (the dissertation defense).

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

A limited number of Research Assistantships are also available through the Biogeochemistry dual-title degree program.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up

deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Contact

Campus	University Park
Graduate Program Head	Mary Ann Victoria Bruns
Program Contact	Mary Ann Victoria Bruns Dept. of Ecosystem Science and Management 116 Ag Sciences Industries Bldg University Park PA 16802 mvb10@psu.edu (814) 863-0779
Program Website	View (http://www.biogeochemistry.psu.edu/)

Bioinformatics and Genomics

Graduate Program Head	David Koslicki
Program Code	BGEN
Campus(es)	Hershey (Ph.D., M.S.) University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Joint M.D./Ph.D. with the College of Medicine
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=BGEN)

The IGDP in BG is an interdepartmental program that engages faculty members from six colleges on two campuses. This broad-reaching program provides students a wide range of understanding of multiple disciplines with specific expertise in a chosen area, and encourages interdisciplinary research that is truly changing biological research as well as health and lifestyles.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

- Fully completed, official online Penn State Graduate Application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>).
- Paid, nonrefundable application fee (see Requirements for Graduate Admission (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/application-fees/>) for current fee).
- Official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>).
- Completed BG-specific questions on the Graduate Application.
- Application for a U.S. visa (international applicants only).
- Names and contact information, including business email addresses, for three references.

- Successful applicants generally will have a minimum 3.5 on a 4.0 scale junior/senior undergraduate grade point average, and will have completed course work in both quantitative and life science subjects.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants.

See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Applicants to the BG program must have a minimum TOEFL total score of 90 with a 19 on the speaking section for the Internet-based test (iBT). Successful applicants generally have a minimum score of 100 (including 23 on the speaking component) on the Internet-based test.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

For master's degree, a minimum of 30 credits at the 400, 500, 600, or 800 level and a 3.0 overall GPA are required. At least 18 credits in the 500 and 600 series combined (thesis option) or 500 series alone (internship plus scholarly paper option) must be included in the program. As part of the application to the graduate program, students will indicate their preference for completing either a thesis or an internship plus a scholarly paper as part of their M.S. training. Approval of the thesis option is contingent on a BG faculty member agreeing to serve as the thesis adviser.

Required courses for all BG master's degree students are:

Code	Title	Credits
Required Courses		
BGEN 551	Genomics	3
MCIBS 554	Foundations in Data Driven Life Sciences	3
Choose one of the following:		3
STAT 500	Applied Statistics	
STAT 501	Regression Methods	
STAT 502	Analysis of Variance and Design of Experiments	
STAT 555	Statistical Analysis of Genomics Data	3
BMMB 852	Applied Bioinformatics	2
BIOL 405	Molecular Evolution	3
BGEN 541	Critical Analysis of Bioinformatics and Genomics Research Topics	3
BGEN 590	Colloquium	1
MCIBS 591	Ethics, Rigor, Reproducibility and Conduct of Research in the Life Sciences	2
Electives		
At least one elective credit must be chosen from a list of approved classes maintained by the graduate program office.		1
Culminating Experience		

Students choosing the M.S. with thesis option must complete original laboratory research (a minimum of 6 credits of BGEN 600) that culminates in a thesis. The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School, and the student must pass a thesis defense.

BGEN 600		6
Students choosing the M.S. with internship plus scholarly paper option must complete independent study (non-thesis research, BGEN 596) and an internship (BGEN 595). Acceptance by the program chair of a scholarly paper reporting results from an original research project is required to fulfill the culminating experience. The internship is separate from the research project and data from the internship are not required for the scholarly paper.		
BGEN 596	Individual Studies	4
BGEN 595	Internship	2
Total Credits		30

Program Options described below for the Ph.D. degree are not offered for the M.S. degree.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

For the Ph.D., a minimum of 35 credits is required. During the first year of study, Ph.D. students are required to take 22 credits of core required courses. Subsequently, 13 credits of elective courses are also required:

Code	Title	Credits
Core Required Courses		
BGEN 551	Genomics	3
MCIBS 554	Foundations in Data Driven Life Sciences	3
BGEN 541	Critical Analysis of Bioinformatics and Genomics Research Topics	3
BGEN 590	Colloquium	1
MCIBS 591	Ethics, Rigor, Reproducibility and Conduct of Research in the Life Sciences	2
BMMB 852	Applied Bioinformatics	2
STAT 555	Statistical Analysis of Genomics Data	3
Choose one of the following:		3
BIOL 405	Molecular Evolution	
BIOL 428	Population Genetics	
BIOL 460	Human Genetics	
BGEN 596	Individual Studies (representing three Research Rotations)	2
Electives		
Elective credits chosen from a list of approved courses maintained by the graduate program office		13
Total Credits		35

Depending on the student's prior background, STAT 500, STAT 501, or STAT 502 may also be required.

Each candidate for the Ph.D. degree must fulfill written and spoken English communication requirements that are satisfied by preparing

written and oral reports describing the laboratory rotations during the first year.

At the end of the first year, continuation in the Ph.D. program is determined by performance in course work, laboratory rotations, and the BG Graduate Program Qualifying Examination. Students join their research laboratory by the end of the second semester of the first year.

The Ph.D. committee is formed following entry into the dissertation laboratory, and must comply with all Graduate Council requirements (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>). Students may consider joint co-advisers, each representing a different area of expertise within the field of bioinformatics and genomics.

During the second year, students may take additional courses in consultation with the Ph.D. committee. Students may select an option area in which they conduct research and take additional courses specified by the Option (see below). Students are not required to choose an Option. Additionally, students will complete a Teaching Experience, which may be fulfilled by serving as a Teaching Assistant for an undergraduate course or a Student Instructional Assistant for a graduate course, the development of content for and delivery of a comprehensive bioinformatics and genomics training workshop, or other pedagogy-related training and practical experience as approved by the program chair.

Ph.D. students must pass a comprehensive examination; to maintain satisfactory progress in the program this should take place by the end of the fifth semester of enrollment. The written portion of the comprehensive examination is in the format of a grant application. As part of this examination, the candidate also gives an oral presentation of this proposal to their Ph.D. committee.

A dissertation must be prepared and defended by each Ph.D. student. Students must present their dissertation in accordance with Graduate Council and Graduate School guidelines as described in the THESIS GUIDE: Requirements for the Preparation of Master's Theses and Doctoral Dissertations (<http://www.gradschool.psu.edu/current-students/etd/thesisdissertationguidepdf/>). To earn the Ph.D. degree, the dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School and the student must pass a final oral examination (the dissertation defense).

The final examination of the doctoral candidate is an oral examination administered and evaluated by the entire Ph.D. committee. It consists of an oral presentation of the dissertation by the candidate and a period of questions and responses. These will relate in large part to the dissertation, but may cover the candidate's entire program of study, because a major purpose of the examination is also to assess the general scholarly attainments of the candidate. The portion of the examination in which the dissertation is presented is open to the University community and the public; therefore, it is expected that the examination will take place at University Park or the Hershey campus. It is expected that the Ph.D. candidate will have at least one paper submitted for publication in a major peer-reviewed scientific journal prior to the final oral examination.

Ph.D. students in Bioinformatics and Genomics may enroll in one of two options, but are not required to do so.

Option in Algorithms and Computation

Students are admitted to the Option in Algorithms and Computation after successfully completing:

1. the first year of the IGDP in BG;
2. three research rotations, of which at least two must be with faculty affiliated with the Algorithms and Computation Option; and
3. the qualifying examination.

During the second year, Ph.D. students choosing this option will be required to take:

Code	Title	Credits
CSE/BMMB 566	Algorithms and Data Structures in Bioinformatics	3
CMPSC 465	Data Structures and Algorithms	3
or CSE 565	Algorithm Design and Analysis	
Two courses from a list of prescribed electives which includes but is not limited to the following:		6
CMPSC 431W	Database Management Systems	
CMPSC 450	Concurrent Scientific Programming	
CSE 557	Concurrent Matrix Computation	
CMPSC 464	Introduction to the Theory of Computation	
CSE 583	Pattern Recognition and Machine Learning	
CSE 562	Probabilistic Algorithms	
CMPEN 455	An Introduction to Digital Image Processing	
CMPEN 454	Fundamentals of Computer Vision	
CHE 512	Optimization and Biological Networks	
Total Credits		12

Option in Statistical Genomics

Students are admitted to the Option in Statistical Genomics, after successfully completing:

- the first year of the IGDP in BG;
- three research rotations, of which at least two must be with faculty affiliated with the Statistical Genomics Option; and
- the qualifying examination.

During the second year, Ph.D. students choosing this option will be required to take:

Code	Title	Credits
STAT 501	Regression Methods	3
or STAT 511	Regression Analysis and Modeling	
STAT 557	Data Mining I	3
Two courses from a list of prescribed electives which includes but is not limited to the following:		6
STAT 414	Introduction to Probability Theory	
STAT 415	Introduction to Mathematical Statistics	
STAT 416	Stochastic Modeling	
STAT 502	Analysis of Variance and Design of Experiments	
STAT 504	Analysis of Discrete Data	
STAT 505	Applied Multivariate Statistical Analysis	
STAT 540	Statistical Computing	
Total Credits		12

Joint Degrees

Joint M.D. / Ph.D. with the College of Medicine

Requirements listed here are in addition to requirements listed in GCAC-211 Joint Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-211-joint-degree-programs/>).

Admission Requirements

Students interested in simultaneously pursuing an M.D. and Ph.D. degree must apply to the College of Medicine M.D. program using the national American Medical College Application Service (AMCAS) application system and indicate their intent to pursue the joint degree program. The College of Medicine M.D./Ph.D. Admissions Committee reviews applications and evaluates candidates for acceptance into both the M.D. and Ph.D. program. Students not accepted into the joint degree program can be referred to either the M.D. or Ph.D. program, depending on their qualifications.

The general admission requirements for the Ph.D. degree are listed on the Admission Requirements tab. Additional requirements for the joint degree are listed below. Admissions requirements and applications for admission for Penn State College of Medicine are available at the M.D. Program (<http://med.psu.edu/md/>) section of the Penn State College of Medicine website. After the review committee has accepted an applicant to the joint degree program, s/he must apply to the Graduate School (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>) for admission to the graduate program.

In addition to the basic college level premedical school requirements for the Penn State College of Medicine (one year each of biology, chemistry, physics, math, and organic chemistry), the M.D./Ph.D. program has the following requirements:

- **Academic Achievement.** Applicants to our program generally have very strong grades and MCAT scores. In recent years, successful applicants have an average GPA of 3.75 and MCAT scores of 33-34. Applicants are not required to take the GREs.
- **Research Experience.** We are especially interested in students with a strong and sustained background in research. Students who have spent 1-2 years after graduation conducting research are strongly encouraged to apply. Alternatively in-depth research experience as an undergraduate can suffice.
- **Recommendations.** We are especially interested in receiving letters of recommendation from faculty with whom you conducted research and who can comment on your passion and potential for research.
- **Goals.** Applicants must be able to clearly articulate the reasons for pursuing the joint degree.
- **International Students.** All qualified students are eligible to apply regardless of citizenship.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the M.D. program are listed on the Penn State College of Medicine (<http://med.psu.edu/md/>) website. Degree requirements for the Ph.D. degree are listed in the Ph.D. Degree Requirements section.

During the first two years of medical school, the student conducts at least three research rotations. After successful completion of the first two years of medical school the candidate enters the BGEN Graduate Program.

During the summer after the second year of medical school, M.D./Ph.D. students take Step 1 of the United States Medical Licensing Examination (USMLE), which serves in lieu of the knowledge-based part of the qualifying examination for the BG program. Successful completion of BMS 506A and BMS 506B, which are taken in the second year of medical school, with a grade of B or higher meets the critical thinking and paper analysis requirement of the qualifying exam.

The Ph.D. committee of an M.D./Ph.D. student in the BG program is formed upon entry into the dissertation laboratory, and must comply with all Graduate Council requirements (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>). The committee must include at least two members of the BG program Graduate Faculty and one M.D./Ph.D. steering committee member.

Code	Title	Credits
Required Courses		
BGEN 590	Colloquium	1
MCIBS 591	Ethics, Rigor, Reproducibility and Conduct of Research in the Life Sciences	2
BGEN 551	Genomics	3
MCIBS 554	Foundations in Data Driven Life Sciences	3
BGEN 541	Critical Analysis of Bioinformatics and Genomics Research Topics	3
STAT 555	Statistical Analysis of Genomics Data	3
BMMB 852	Applied Bioinformatics	2
Electives		
Elective credits chosen from a list of approved courses maintained by the graduate program office; must include an evolutionary genomics course (BIOL 405, BIOL 428, BIOL 460, or another evolutionary genomics course approved by the program chair); depending on student's prior background, STAT 500, STAT 501, or STAT 502 may also be required.		6
Total Credits		23

The BG program will accept SPM 711 in lieu of 6 credits of elective courses and 2 credits of BGEN 596. If students accepted into the joint degree program are unable to complete the M.D. degree, they are still eligible to receive the Ph.D. degree if all Ph.D. degree requirements have been satisfied.

The College of Medicine will accept 8 credits of BGEN 600/BGEN 601 Thesis Research/Ph.D. Dissertation conducted over the four years of the graduate portion of the training program in lieu of two months of elective rotations (MED 797). In addition, the College of Medicine requires all M.D. students to complete a Medical Student Research project; this requirement is waived for all M.D./Ph.D. students.

The M.D./Ph.D. student prepares a written comprehensive examination in the format of a grant application and gives an oral presentation of this proposal to their Ph.D. committee.

M.D./Ph.D. candidates are required to have at least one paper submitted for publication in a major peer-reviewed scientific journal prior to the final doctoral examination, and this must be accepted before they return to the third year of medical school. A dissertation must be prepared and defended by each M.D./Ph.D. candidate.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Molecular, Cellular, and Integrative Biosciences (MCIBS) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/mcibs/>)

Learning Outcomes

- Know:** demonstrate knowledge of core principles and primary literature in their specialty area including comprehension of methods, results, and data analysis in the specialty area.
- Apply/Create:** demonstrate ability to design and carryout a major research project in the field, including a description of previous work in the field and assemble new findings into a written work that advances understanding in the field.
- Communicate:** demonstrate ability to convey scientific ideas and results in clear, concise and original writing as well as formal oral presentations.
- Think:** demonstrate ability to critically analyze work by others in the fields of bioinformatics, computational, statistical, functional and evolutionary genomics.

- Professional Practice:** demonstrate comprehension of and commitment to ethical standards in the discipline. Demonstrate the ability to teach key concepts.
- Teach:** demonstrate the ability to teach key concepts of the discipline of bioinformatics, computational, statistical, functional and evolutionary genomics.

Contact

Campus	Hershey Med Ctr
Graduate Program Head	David Koslicki
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Dajiang Liu
Program Contact	Freya Heryla 101 Huck Life Sciences Building University Park PA 16802 fqh5144@psu.edu (814) 863-3273
Program Website	View (https://www.huck.psu.edu/graduate-programs/bioinformatics-and-genomics/)
Campus	University Park
Graduate Program Head	David Koslicki
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Qunhua Li
Program Contact	Freya Heryla 101 Huck Life Science Building University Park PA 16802 fqh5144@psu.edu (814) 863-3273
Program Website	View (https://www.huck.psu.edu/graduate-programs/bioinformatics-and-genomics/)

Biology

Graduate Program Head	Elizabeth McGraw
Program Code	BIOL
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=BIOL)

The Biology graduate program encompasses a broad spectrum of research areas, including bioinformatics, cell biology, developmental biology, ecology, evolution, genetics, neuroscience, phylogenetics, and physiology. The courses of study are planned individually by the student and a Graduate Faculty adviser, often with input from the student's doctoral committee. Typically, tenure-line and tenured faculty in Biology have 1 to 5 graduate students in their laboratories, leading to a low student/adviser ratio for both doctoral and master's students.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to

Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Admission is restricted to students who have the baccalaureate degree in a biological science or related field and who present a cumulative undergraduate average of at least 3.00 on a scale of 4.00. Each applicant must provide a personal statement of interests and objectives, curriculum vitae/cv/resume, and letters from three persons verifying the applicant's academic preparedness and readiness for graduate study. GRE scores will not be accepted.

Degree Requirements

Master of science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A minimum of 30 credits at the 400, 500, 600, or 800 level is required, with least 18 credits at the 500 and 600 level, combined. Students are required to write a thesis, and at least 6 credits in thesis research (BIOL 600 or BIOL 610) must be taken in conjunction with completing the thesis. The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School, and the student must pass a thesis defense. The master's program in Biology is usually completed within two years.

Four Biology courses are curricular requirements for all master's students, as is the successful completion of ethics training administered by the Collaborative Institutional Training Initiative (CITI). Additional course work is tailored to the student's research interests after advance consultation with their adviser, and specific courses may be required by the adviser depending on the student's background and research plans.

Code	Title	Credits
Required Courses		
BIOL 590	Colloquium	2
BIOL 592	Critical Evaluation of Literature in Biology	1
BIOL 893	Experiential Teaching in Biology	2
BIOL 400	Teaching in Biology	1
Total Credits		6

The culminating experience for the Master of Science degree is a research-based thesis that generally results in a peer-reviewed publication. The student will present and defend the thesis to a committee of three tenured or tenure-line Graduate Faculty members, consisting of the adviser and two other members of the Graduate Faculty. At least two members of the committee, including the adviser, must be members of the Graduate Faculty in the Biology graduate program.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The doctoral program in Biology is first and foremost a research-oriented program. The single most important component is the successful completion and defense of an original research project – the dissertation. Additionally, the Biology graduate program and Graduate Council policies require that students meet certain residency requirements, maintain satisfactory scholastic performance, demonstrate competency of the English language, and successfully pass qualifying,

comprehensive, and final oral examinations, outlined in the link above. To earn the Ph.D. degree, doctoral candidates must write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Four Biology courses are curricular requirements for all doctoral students, as is the successful completion of ethics training administered by the Collaborative Institutional Training Initiative (CITI). Although doctoral students are required to complete 4 credits of BIOL 602 Supervised Experience in College Teaching, these 4 credits cannot be counted towards the degree requirements.

Code	Title	Credits
Required Courses		
BIOL 590	Colloquium	4
BIOL 592	Critical Evaluation of Literature in Biology	1
BIOL 893	Experiential Teaching in Biology	2
BIOL 602	Supervised Experience in College Teaching	4
Total Credits		11

Additional course work is tailored to the student's research interests after advance consultation with their adviser and Ph.D. committee, and specific courses may be required by the adviser and/or Ph.D. committee depending on the student's background and research plans. All doctoral students must pass a written and oral qualifying examination that is usually administered during their third semester of study. After a student has completed all of their course work and made substantial progress on the design and execution of their dissertation research, a comprehensive examination is administered by their Ph.D. committee. The dissertation must represent a significant original contribution suitable for publication, and will usually require between two and four years of laboratory and/or field research. When complete the dissertation must be defended before the student's Ph.D. committee (the final oral examination). The defense is normally immediately preceded by a public presentation of the thesis research by the student.

Molecular Evolutionary Biology Option

The department awards graduate degrees in Biology covering the full spectrum of subjects represented by our diverse faculty in the base degree programs described above. If desired, a student may also elect to pursue the following option as part of his/her program of study.

1. The student must meet the criteria for the M.S. or Ph.D. in Biology.
2. The student's research adviser must be a member of the Graduate Faculty in the Biology graduate program and/or a full member of the Institute of Molecular Evolutionary Genetics. Other committee members may be chosen as needed providing that a majority of the committee is associated with the IMEG.
3. In addition to the normal Biology program requirements, the student must take (for both an M.S. or Ph.D. in Biology):

Code	Title	Credits
Required Courses		
BIOL 591	Molecular Evolutionary Biology Seminar	3
9 credits from among the following courses (selected in consultation with the student's committee):		9
BIOL 405	Molecular Evolution	
BIOL 422	Advanced Genetics	
BIOL 427	Evolution	
BIOL 428	Population Genetics	

BIOL 514 Topics in Systematics and Evolution

Total Credits

12

4. The student must complete any other course work or training deemed appropriate by the student's committee.

1.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

In addition, several graduate fellowships and scholarships are available for students within the Department of Biology.

Programs of study are planned to require no more than two years for the M.S. degree and five for the Ph.D. degree. A student transferring to the department with the M.S. degree should plan on four additional years. Financial support from teaching or research assistantships or from fellowships is available to students in good standing, but not awarded beyond these limits except in unusual cases.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Biology (BIOL) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/biol/>)

Learning Outcomes

1. **Knowledge:** Demonstrate comprehensive knowledge of their major concentration area within biology including the fundamental questions in the field. The comprehensive knowledge may integrate multiple areas of biology. Demonstrate knowledge in other relevant areas of concentration (statistics) necessary for research in the biological sciences.
2. **Apply:** Demonstrate advanced research skills, including posing hypotheses, designing critical experiments, collecting data, evaluating data, and drawing conclusions in the study of biological problems.
3. **Communication:** Use professional standards of the field of Biology from evaluation of literature to communication of research findings in written and spoken presentations. These presentations might include talks or posters given at local or national meetings.
4. **Create:** Make an original and substantial contribution to the field of Biology and produce publishable scholarship that is presented within multiple chapters within their dissertation. Ideally, students will submit and publish research papers in peer reviewed journals during the course of their Ph.D. program.
5. **Teach:** Demonstrate effective skills in undergraduate teaching using effective pedagogical practice.

Contact

Campus	University Park
Graduate Program Head	Elizabeth Ann McGraw
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Timothy J Jegla
Program Contact	Jennifer L Knecht 208 Mueller Lab University Park PA 16802 jlk67@psu.edu (814) 863-7034
Program Website	View (http://bio.psu.edu/)

Biomedical Engineering

Graduate Program Head	Daniel Hayes
Program Code	BME
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=BME)

The Department of Biomedical Engineering offers Ph.D. and M.S. degree programs consisting of integrated graduate-level training in engineering, the life sciences and the medical sciences. Students graduating from this program will have acquired expertise in the application of engineering principles to fundamental problems in biology, clinical problems in medicine, or in the development of new biomedical instrumentation. They are also expected to produce scholarly work to be published in peer-reviewed journals and presented at scholarly conferences. Graduate curricula and student assessment in biomedical engineering is under the direction of the program chair and a graduate curriculum committee drawn from the faculty in the Biomedical Engineering Department.

Opportunities for specialized research are offered by graduate faculty working on electrical, mechanical, and biophysical properties of biological materials and the application of this knowledge to understanding molecular, cellular, tissue, and organ level processes involved in health and disease. Specific applications include: artificial organs, biomaterials, bioMEMs, nanotechnology, biophotonics, cellular and medical imaging, cardiovascular engineering, cell signaling and protein dynamics, mechanobiology, systems biology, bioinformatics, tissue engineering and regenerative medicine. Extensive computer facilities and specialized equipment are available to support a combination of studies that employ experimental observations and their analysis through mathematical modeling and computer simulations.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Scores from the Graduate Record Examinations (GRE) are not required for admission.

Students with a degree in engineering, physics, or the life sciences from an approved institution are eligible for admission. All students must have a strong background in physics and mathematics. This background should include chemistry, calculus-based physics, and mathematics through calculus and differential equations. Students who lack this background may still be considered for provisional admission (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-303-provisional-admission/>) but will have to make up any deficiency early in their graduate program. These remedial courses will be required in addition to the stated graduate program course requirements. Students with a 3.0 (or higher) junior/senior GPA and with appropriate course backgrounds will be considered for admission. The best-qualified applicants will be accepted up to the number of spaces available. Exceptions to the minimum average may be made for students with special backgrounds, abilities, and interests, at the discretion of the program.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A minimum of 30 credits at the 400, 500, 600, or 800 level is required, with at least 24 credits in BME/BIOE at the 500 or 800 level. Students choosing to complete a scholarly paper must complete at least 32 credits, with 18 credits in 500-level courses. Students choosing to complete a thesis must complete a minimum of 30 credits with at least 24 credits at the 500, 600, or 800-level. Students choosing to complete a thesis must also complete at least 6 credits in thesis research (600 or 610).

Non-Thesis (Scholarly Paper) Track

Students choosing to complete a scholarly paper must take the following:

Code	Title	Credits
Required Courses		
9 credits of foundation courses at the BIOE 500-level		9
12 credits of fundamentals and/or applications courses (with a minimum of 3 credits from each category)		12
BIOE 591	Bioengineering Ethics and Professional Development	1
BIOE 590	Colloquium (two 1-credit graduate seminars)	2
BME 429	Biomedical Mechanics and Techniques Laboratory	2
Culminating Experience		
BME 594	Research Topics	6
Total Credits		32

To complete the degree in one year, students are required to take at least one credit of research for each of the three semesters (Fall, Spring, and Summer). A research adviser must be assigned to students in their first semester, as selection and discussion of the student's research topic must begin as soon as possible. Students who need more time to complete the final paper must be allowed to complete the paper, and have it reviewed and approved after the third semester (Summer) has ended. Students are not required to remain in residence while they complete the final paper. However, extensions granted to students in this program must comply with the Graduate Council policy on deferred grades (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-400/gcac-401-grading-system/>).

Mentored Projects: By the end of September, a student will identify an adviser. A mentored project assigned by the adviser will be completed and a culminating project using the data as a basis for the scholarly paper will be submitted and evaluated. These projects are completed while enrolled in BME 594.

Thesis Track

For students choosing to complete a thesis, upon entering the program, the student, along with their research adviser, will select an academic advisory committee. Working with this committee, the student will select courses appropriate to their research and their professional goals.

Course expectations are set up so that course work during the semester will require up to half of the students' time with research activities taking up the majority of the time. Summers are generally set aside for full-time research. Beyond the specific course requirements listed below, M.S. students are expected to publish at least one first-author paper based on their research. This is not a requirement for graduation, however.

Students choosing to complete a thesis must take the following:

Code	Title	Credits
Required Courses		
12 credits of lecture- or laboratory-based coursework at the 500-level ¹		12
6 credits of lecture- or laboratory-based coursework at the 400- or 500-level ¹		6
BIOE 591	Bioengineering Ethics and Professional Development	1
1-credit graduate seminar for every semester in attendance		4
Electives ²		1

Culminating Experience

BIOE 600	Thesis Research	6
Total Credits		30

¹ Course work must include at least 6 credits each in bioengineering, life sciences, and technical/quantitative electives.

² Students will select additional course work and research credits from a list of approved electives maintained by the program office, as appropriate, to obtain the total minimum of 30 credits.

The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School, and the student must pass a thesis defense.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Upon entering the Ph.D. program, the student will be assigned an academic advisory committee, consisting of three members of the Biomedical Engineering Graduate Faculty (including the adviser). Working with this committee, the student will select courses appropriate to their research and professional goals.

The minimum credit requirements for a Ph.D. in Biomedical Engineering are as follows:

Code	Title	Credits
Required Courses		
6 credits each in Biomedical Engineering, life sciences, and technical/quantitative electives		6
12 credits that are lecture- or laboratory-based (not independent study) and at the 500-level		12
6 credits at the 500-level in courses relevant to their research		6
4 credits in graduate program seminar series (1 credit every semester until passing the comprehensive exam)		4
BIOE 591	Bioengineering Ethics and Professional Development	1
Total Credits		29

600-level research credits are assigned every semester in attendance. Graduate credits earned at other institutions, including those used toward a degree, may be used to satisfy some of the Ph.D. degree requirements at Penn State, but in these cases, credits are not transferred. Regardless of previous courses taken, every doctoral student must take a minimum of 6 credits at the 500-level at the University Park campus.

Supporting courses are available at University Park in: anatomy, biochemistry, biology, biophysics, chemistry, laboratory animal medicine, materials science, mathematics, physics, physiology, and the engineering departments.

Students who enter the Ph.D. program with a master's degree will work with their Ph.D. committee to determine the suitability of substitutions for courses already taken.

Exams

The Qualifying Exam is the first of three formal exams required for a Ph.D. The exam is taken at the end of the first year of study, typically during the summer following Spring semester. The exam is also given

at the end of Fall semester. The purpose of the Qualifying Exam is to ensure that students possess the qualifications expected of a Ph.D. student and have the potential to perform at the high level expected of a Ph.D. biomedical engineer upon completion of the degree. The format of the exam is a written proposal on a research topic different from the student's dissertation project, followed by an oral defense.

The next step toward the Ph.D. degree is the comprehensive exam, which is given when the student has completed all required course work. The comprehensive exam is generally given between the end of the second year and the end of the third year of the Ph.D. program and must take place at least one year prior to the Ph.D. dissertation defense (final oral examination). The exam is intended to evaluate the student's mastery of the major (and if appropriate, minor) field. The Biomedical Engineering Program uses the comprehensive exam as an opportunity to evaluate the Ph.D. student's dissertation proposal. In preparation for the exam, the student must have formed a Ph.D. committee, scheduled an exam time, and prepared a detailed Ph.D. dissertation proposal according to departmental guidelines.

Ph.D. students must have satisfied the English competence and the communication requirement before scheduling the comprehensive exam. This requirement is fulfilled during the oral Qualifying Exam. The Ph.D. committee must meet all Graduate Council requirements (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>).

The doctoral candidate who has satisfied all other requirements for the degree will be scheduled to take the final oral examination. According to Biomedical Engineering Program policy, the final oral exam may not be scheduled until at least one year after the comprehensive exam was passed. Every Ph.D. student must meet with their Ph.D. Committee. This meeting is to preview the dissertation structure with the committee and to ensure that the student, adviser, and committee all agree on expectations for the dissertation and defense.

To earn the Ph.D. degree, doctoral candidates must write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School, and the student must pass a final oral examination (the dissertation defense).

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)

- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

- Graduates will be able to demonstrate an understanding of, and a commitment to, the standards for scholarship, professional practice, and research integrity.

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Biomedical Engineering (BME) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/bme/>)

Learning Outcomes

Master of Science (M.S.)

- Graduates will be able to demonstrate understanding of advanced core principles and methods from selected sub-fields of Biomedical engineering at a depth consistent with their course of study.
- Graduates will be able to apply their knowledge of selected sub-fields of Biomedical engineering to formulate and solve engineering problems.
- Graduates will be able to analyze and synthesize knowledge within the field of Biomedical engineering to extend existing knowledge through a research experience and thesis.
- Graduates will be able to demonstrate proficiency in oral and written communication appropriate to their discipline.
- Graduates will be able to demonstrate an understanding of, and a commitment to, the standards for scholarship and research integrity within Biomedical Engineering.

Doctor of Philosophy (Ph.D.)

- Graduates will be able to demonstrate an understanding of advanced core principles and methods as well as modern research findings from selected sub-fields of Biomedical engineering at a depth appropriate for a Ph.D. candidate.
- Graduates will be able to apply their knowledge of selected sub-fields of Biomedical engineering in formulating and executing a research plan.
- Graduates will be able to demonstrate the ability to analyze and synthesize appropriate literature, to critically review their work in the context of the literature, and to formulate and defend conclusions based on their research that represent new scholarly contributions.
- Graduates will be able to demonstrate high levels of proficiency in oral and written communication.

Contact

Campus	University Park
Graduate Program Head	Daniel J Hayes
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Yuguo Lei
Program Contact	Virginia Simparosa 122B CBEB University Park PA 16802 vls5248@psu.edu (814) 865-8087
Program Website	View (http://www.bme.psu.edu/)

Biomedical Sciences

Graduate Program Head	Lisa Shantz
Program Code	BMS
Campus(es)	Hershey (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Dual-Title Ph.D. in Biomedical Sciences and Clinical and Translational Science Joint M.D./Ph.D. with the College of Medicine
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=BMS)

The Biomedical Sciences (BMS) Graduate Program with its Options in Biochemistry, Genetics, and Genomics, Cancer Biology, Cellular and Integrative Physiology, Translational Therapeutics, and Virology and Immunology provides students curricular training with a unique focus on human health and disease and the opportunity to concentrate in one or more disciplinary approaches including: biochemistry, biophysics, cell biology, genetics, immunology, pharmacology, physiology, structural biology, and virology. Students receive rigorous training that provides the skills necessary to be leaders in biomedical research and other endeavors that benefit from advanced scientific training, including industry, education, intellectual property development, technology licensing, journalism, entrepreneurship, and public policy.

The BMS Graduate Program is an interdepartmental program that engages faculty from numerous basic science and clinical departments. This broad-reaching program provides students a wide-ranging understanding of multiple disciplines with specific expertise in a chosen area, and encourages interdisciplinary research that is the hallmark of biomedical sciences in the 21st century.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

1. Submission of online Penn State Graduate School application (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>) and payment of nonrefundable application fee
2. Three letters of recommendation
3. Statement of goals including
 - a. reasons for applying to the BMS Graduate Program,
 - b. previous research experiences,
 - c. particular areas of research interests if known, and
 - d. long-term career goals
4. Official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>); Note that post-secondary course work should include biochemistry and molecular biology or genetics.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

To receive the M.S. degree in BMS, at least 32 credits from courses at the 400, 500, 600, and 800 level are required, with at least 18 credits at the 500 and 600 level, combined.

Code	Title	Credits
Required Courses		
BMS 502	Cell and Systems Biology	3
BMS 503	Advanced Molecular Genetics	3
BMS 504	Art of Scientific Communication I	1
BMS 505	Art of Scientific Communication II	1
BMS 590	Colloquium	2
BMS 591	Biomedical Research Ethics	1
BMS 596	Individual Studies (Research Rotation)	2
Colloquium or Journal Club fulfilled by taking 2 credits of any of the following:		2
BICHEM 590	Colloquium	
BMS 553	Cancer Biology Colloquium	
PHARM 590	Colloquium	
PSIO 501	Scientific Analysis and Presentation	
MICRO 572	Literature Reports	
MICRO 590	Colloquium	
NEURO 590	Colloquium	
VIRIM 580	Critical Reading in Immunobiology	
Electives		
At least 11 credits of elective courses at the 500 or 800 level selected in consultation with the student's thesis adviser and thesis committee.		11
Thesis Research		
BMS 600	Thesis Research ¹	6
Total Credits		32

¹ No more than 6 credits of BMS 600 may be counted toward the 32 credit minimum.

Each candidate for the M.S. degree must fulfill written and spoken English communication requirements that are satisfied by preparing written and oral reports describing the laboratory rotations during the first year.

Students must complete original laboratory research that culminates in a thesis. The thesis must be accepted by the master's committee, the chair of the graduate program, and the Graduate School.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

To receive the Ph.D. degree in Biomedical Sciences, at least 29 credits from courses at the 400, 500, 600, and 800 level are required.

Code	Title	Credits
Required Courses		
BMS 502	Cell and Systems Biology	3
BMS 503	Advanced Molecular Genetics	3
BMS 504	Art of Scientific Communication I	1
BMS 505	Art of Scientific Communication II	1
BMS 590	Colloquium	5
BMS 591	Biomedical Research Ethics	1
BMS 596	Individual Studies (Research)	2
BMS 801	Writing Grant Proposals for Biomedical Research	1
Colloquium or Journal Club fulfilled by taking 2 credits of any of the following:		2
BICHEM 590	Colloquium	
BMS 553	Cancer Biology Colloquium	
PHARM 590	Colloquium	
PSIO 501	Scientific Analysis and Presentation	
MICRO 572	Literature Reports	
MICRO 590	Colloquium	
NEURO 590	Colloquium	
VIRIM 580	Critical Reading in Immunobiology	
Electives		
At least 10 credits of elective courses at the 500 or 800 level selected in consultation with the student's dissertation adviser and Ph.D. committee.		10
Total Credits		29

Each candidate for the Ph.D. degree must fulfill written and spoken English communication requirements that are satisfied by preparing written and oral reports describing the laboratory rotations during the first year.

The first-year Fall curriculum provides the student an understanding of basic cellular processes through a core curriculum that includes two integrated three-credit courses: Advanced Molecular Genetics (BMS 503) and Cell and Systems Biology (BMS 502). These courses develop concepts related to genome structure and function, regulation of gene expression, regulation of energy supply and demand, cellular and subcellular structures, cell-to-cell signaling, and the organization and function of cells in multicellular systems. The Fall curriculum also includes the one-credit Art of Scientific Communication I (BMS 504) course that reinforces concepts developed in the integrated courses and

aids students in the transition from textbooks to primary literature as a source of information.

The first-year Spring curriculum offers an opportunity to explore one or more curricular paths that lead to entry into one of the Options or to design an individualized curricular path within the BMS Graduate Program. The Spring curriculum also includes the one-credit Art of Scientific Communication II (BMS 505) course that further develops the student's knowledge acquisition from the primary literature and assists improvement of presentation and writing skills necessary for subsequent journal clubs, literature-based courses, and scientific learning and discourse throughout their career.

In addition, students complete at least three research rotations during the first year that expose them to the wide range of research interests of the Penn State Graduate Faculty from both basic and clinical science departments at the College of Medicine in Hershey. These rotations serve to inform the students with regard to choosing a dissertation adviser and Ph.D. committee.

The BMS Graduate Program Executive Committee, which includes representation from the Program and each Option of the Program, advises students about academic and related matters until the student has a dissertation adviser. If desired, students formally make a decision to join an Option by the end of the Spring semester of their first year and must satisfy all admission requirements of the Option.

Students must have a dissertation adviser by the end of the summer of the first year. The student and dissertation adviser then plan additional course work and develop a research plan in consultation with the Ph.D. committee.

Curriculum in the second year is determined by the choice to participate in one of the Options, or an individualized curricular path designed by the student in consultation with the dissertation adviser and Ph.D. committee.

All doctoral students must pass a qualifying examination, a comprehensive examination, and a final oral examination (the dissertation defense). At the end of the first year, continuation in the Ph.D. program is determined by performance in course work, laboratory rotations, and the BMS Graduate Program Qualifying Examination. Students join their research laboratory by the end of the summer of the first year.

Ph.D. students prepare a written comprehensive examination in the format of a grant application prior to the end of the fifth semester of enrollment. As part of this examination, the candidate also gives an oral presentation of this proposal to their Ph.D. committee.

To earn the Ph.D. degree, doctoral students must write a dissertation that is accepted by the Ph.D. committee, the chair of the graduate program, and the Graduate School. Students are required to have at least one first-author publication accepted or published based on their dissertation research prior to the final oral examination. A student may petition the Chair of the BMS Graduate Program to waive this requirement due to extenuating circumstances (e.g., adviser relocation, abnormal issues with publication process). All waivers must be approved by the Vice Dean for Research and Graduate Studies of the College of Medicine.

OPTIONS

The Options offered within the BMS Graduate Program provide the student a curricular specialization focused on different approaches to biomedical research.

Biochemistry, Genetics, and Genomics (BGG) Option

The objective of the BGG Option is to provide course work and laboratory training that focus on the principles and application of biochemical, genetic, and genomic analysis. These approaches play key roles in identifying and characterizing cellular processes and elucidating the structure and function of key macromolecules including DNA, RNA, proteins, lipids, and carbohydrates. The Option also stresses the biological intersections of these classes of macromolecules. The combination of didactic courses, colloquia, seminars, and laboratory research provides students with an integrated approach for applying biochemical, genetic, and genomic analyses to interrogate and manipulate basic cellular processes and macromolecules of biomedical significance. The training afforded by this Option exposes graduates to the fundamentals needed to experimentally address scientific questions in areas such as epigenetic control of gene expression, structure/function, biomolecular engineering, and systems analysis using these approaches.

Admission Requirements

To be admitted to the BGG Option, students must successfully complete:

1. the first year of the BMS Graduate Program, and
2. three research rotations, at least two with faculty in the BGG Option.

Degree Requirements for the M.S.

In addition to the 13 credits of required BMS Core Courses for the M.S. degree and 6 credits of thesis research, students pursuing the M.S. degree in the BGG Option must take:

Code	Title	Credits
Required Courses		
BMS 512	Data Analysis For The Biomedical Laboratory Scientist, A Practical Approach	2
BCHEM 590	Colloquium	2
At least 6 credits from the following courses:		6
BCHEM 522	Molecular Genetics: Genes to Genomes	
BCHEM 581	Enzymology: Structure, Energetics, and Function-A. Structural Biology	
BCHEM 582	Enzymology: Structure, Energetics, and Function-B. Practical Enzymology	
BCHEM 583	Enzymology: Structure, Energetics, and Function-C. Mechanisms of Enzyme Reactions	
GENET 582	Genetics of Model Organisms: Molecular Genetic Analysis of Signaling Pathways: B	
GENET 587	Genetic Approaches to Biomedical Problems	
MCIBS 551	Genomics	
At least 3 credits of 500-level elective courses selected in consultation with the student's thesis adviser and thesis committee.		3
Total Credits		13

degree Requirements for the Ph.D.

In addition to the 17 credits of required BMS Core Courses for the Ph.D. degree, students pursuing the Ph.D. degree in the BGG Option must take:

Code	Title	Credits
Required Courses		
BMS 512	Data Analysis For The Biomedical Laboratory Scientist, A Practical Approach	2
BCHEM 590	Colloquium	2
At least 6 credits from the following courses:		6
BCHEM 522	Molecular Genetics: Genes to Genomes	
BCHEM 581	Enzymology: Structure, Energetics, and Function-A. Structural Biology	
BCHEM 582	Enzymology: Structure, Energetics, and Function-B. Practical Enzymology	
BCHEM 583	Enzymology: Structure, Energetics, and Function-C. Mechanisms of Enzyme Reactions	
GENET 582	Genetics of Model Organisms: Molecular Genetic Analysis of Signaling Pathways: B	
GENET 587	Genetic Approaches to Biomedical Problems	
MCIBS 551	Genomics	
At least 2 credits of 500-level elective courses selected in consultation with the student's dissertation adviser and Ph.D. committee.		2
Total Credits		12

Cancer biology (CB) Option

The CB Option provides comprehensive, interdisciplinary training in cancer research, thus preparing students to pursue competitive careers in the field of cancer biology. The Option provides fundamental knowledge in cancer biology, while emphasizing state-of-the-art research approaches. The curriculum provides an appreciation for the dynamic nature of cancer research by exposing students to current paradigms in this quickly changing field of research. The CB Option includes courses that highlight essential knowledge of the basic cellular and molecular mechanisms underlying cancer etiology, cancer progression, and metastasis, together with an understanding of translational research and cancer treatment. The Option also allows flexibility for students to individually tailor their studies by choosing additional CB courses in basic, population, or clinical science aspects of cancer research. This intensive training program will prepare trainees for advanced careers in a variety of areas of cancer research.

Admission Requirements

To be admitted to the CB Option, students must successfully complete:

1. the first year of the BMS Graduate Program, and
2. three research rotations, at least two with faculty in the CB Option.

Degree Requirements for the M.S.

In addition to the 13 credits of required BMS Core Courses for the M.S. degree and 6 credits of thesis research, students pursuing the M.S. degree in the CB Option must take:

Code	Title	Credits
Required Courses		
BMS 550	Fundamentals of Cancer Biology	1
BMS 551	Cancer Genetics	1
BMS 552	Tumor Metabolism	1
BMS 553	Cancer Biology Colloquium	2
BMS 554	Cancer Therapy and Immunology	2
At least 3 credits from the following courses:		3
BCHEM 510	Carcinogenesis and Chemoprevention	

BMS 568	Current Topics in Translational Cancer Research	
BMS 571	Graduate Clinical Rotation	
PHS 552	Molecular Epidemiology of Chronic Disease	
3 credits of 500-level elective courses selected in consultation with the student's thesis adviser and thesis committee.		3
Total Credits		13

Degree Requirements for the Ph.D.

In addition to the 17 credits of required BMS Core Courses for the Ph.D. degree, students pursuing the Ph.D. degree in the CB Option must take:

Code	Title	Credits
Required Courses		
BMS 550	Fundamentals of Cancer Biology	1
BMS 551	Cancer Genetics	1
BMS 552	Tumor Metabolism	1
BMS 553	Cancer Biology Colloquium	2
BMS 554	Cancer Therapy and Immunology	2
At least 3 credits from the following courses:		3
BCHEM 510	Carcinogenesis and Chemoprevention	
BMS 568	Current Topics in Translational Cancer Research	
BMS 571	Graduate Clinical Rotation	
PHS 552	Molecular Epidemiology of Chronic Disease	
2 credits of 500-level elective courses selected in consultation with the student's thesis adviser and thesis committee.		2
Total Credits		12

Cellular and Integrative Physiology (CIP) Option

The objective of the CIP Option is to provide students training that focuses on cellular and integrative physiology, which includes the functions and interactions between different tissues and cell types and different organ systems. The training afforded by this Option exposes graduates to the fundamentals needed to experimentally address scientific questions in areas such as intracellular organization, and the regulation of key biological processes including cell signaling, ion channel and transport function, gene expression, protein translation and turnover, molecular motors, and intercellular communication. In addition, the Option stresses the importance of systems biology and inter-organ signaling to understand the biological basis of health and disease. The combination of didactic courses, colloquia, seminars, and laboratory research provides students with an integrated approach for applying advanced imaging, biochemical, and molecular analyses to interrogate and manipulate basic cellular processes and macromolecules of biomedical significance.

Admission Requirements

To be admitted to the CIP Option, students must successfully complete:

1. the first year of the BMS Graduate Program, and
2. three research rotations, at least two with faculty in the CIP Option.

Degree Requirements for the M.S.

In addition to the 13 credits of required BMS Core Courses for the M.S. degree and 6 credits of thesis research, students pursuing the M.S. degree in the CIP Option must take:

Code	Title	Credits
Required Courses		
PSIO 504	Cellular and Integrative Physiology	3

PSIO 505	Cellular and Integrative Physiology II	3
BMS 581	Molecular and Translational Approaches to Human Disease	3
PSIO 501	Scientific Analysis and Presentation	2
At least 2 credits of 500-level elective courses selected in consultation with the student's thesis adviser and thesis committee.		2
Total Credits		13

degree Requirements for the Ph.D.

In addition to the 17 credits of required BMS Core Courses for the Ph.D. degree, students pursuing the Ph.D. degree in the CIP Option must take:

Code	Title	Credits
Required Courses		
PSIO 504	Cellular and Integrative Physiology	3
PSIO 505	Cellular and Integrative Physiology II	3
BMS 581	Molecular and Translational Approaches to Human Disease	3
PSIO 501	Scientific Analysis and Presentation	2
At least 1 credit of a 500-level elective course selected in consultation with the student's dissertation adviser and Ph.D. committee.		1
Total Credits		12

Translational Therapeutics (TT) Option

The TT Option is designed to give students a combination of didactic instruction, informal interaction, and laboratory experience that enables them to obtain a firm foundation in the principles, methods, and contributions of pharmacology, defined broadly as the science of the interaction of chemical agents with biological systems. Of primary importance, this Option focuses on identification of disease targets, development of therapeutic strategies, and refinement of drug delivery approaches. With this preparation, graduates of the TT Option will be capable of designing and executing high-quality independent research, and of assuming positions of responsibility within the therapeutic community.

This Option offers studies in the general areas of drug discovery and development, molecular pathophysiology, drug metabolism, molecular pharmacology, endocrine pharmacology, neuropharmacology, cardiovascular-renal pharmacology, pharmacogenetics, and clinical pharmacology. Primary emphasis is placed on the molecular mechanism by which drugs act in the body and by which the body transforms drugs.

Admission Requirements

To be admitted to the TT Option, students must successfully complete:

1. the first year of the BMS Graduate Program, and
2. three research rotations, at least two with faculty in the TT Option.

Degree Requirements for the M.S.

In addition to the 13 credits of required BMS Core Courses for the M.S. degree and 6 credits of thesis research, students pursuing the M.S. degree in the TT Option must take:

Code	Title	Credits
Required Courses		
PHARM 520	Principles of Drug Action	2
PHARM 551	Anti-infective Therapeutics	1
PHARM 552	Integrated System Pharmacology	1

PHARM 553	Gastrointestinal and Immunomodulatory Therapeutics	1
PHARM 554	Anticancer Therapeutics	1
PHARM 561	Neuropharmacology	2
PHARM 562	Endocrine Pharmacology	2
PHARM 590	Colloquium	1
At least 2 credits of 500-level elective courses selected in consultation with the student's thesis advisor and thesis committee.		2
Total Credits		13

Degree Requirements for the Ph.D.

In addition to the 17 credits of required BMS Core Courses for the Ph.D. degree, students pursuing the Ph.D. degree in the TT Option must take:

Code	Title	Credits
Required Courses		
PHARM 520	Principles of Drug Action	2
PHARM 551	Anti-infective Therapeutics	1
PHARM 552	Integrated System Pharmacology	1
PHARM 553	Gastrointestinal and Immunomodulatory Therapeutics	1
PHARM 554	Anticancer Therapeutics	1
PHARM 561	Neuropharmacology	2
PHARM 562	Endocrine Pharmacology	2
PHARM 590	Colloquium	1
At least 1 credit of a 500-level elective course selected in consultation with the candidate's dissertation adviser and Ph.D. committee.		1
Total Credits		12

Virology and Immunology (VIRIM) Option

The objective of the VIRIM Option is to provide graduate students the opportunity to focus their graduate-level coursework and laboratory research in areas related to virology and immunology. The areas of research within virology include viral oncology, virus-cell interactions, the structure and assembly of viruses, functional role of viral gene products, the molecular biology of virus replication, and viral induced latency. The areas of research within immunology include adaptive and innate immunity, cellular and humoral immunity, antigen presentation, tumor immunology, vaccine development, and neuroimmunology. The VIRIM Option allows students to develop an integrative research approach using aspects of biochemistry, molecular and cellular biology, and genetics to approach scientific questions associated with areas of virology and immunology.

Admission Requirements

To be admitted to the VIRIM Option, students must successfully complete:

1. the first year of the BMS Graduate Program, and
2. three research rotations, at least two with faculty members in the VIRIM Option.

Degree Requirements for the M.S.

In addition to the 13 credits of required BMS Core Courses for the M.S. degree and 6 credits of thesis research, students pursuing the M.S. degree in the VIRIM Option must take:

Code	Title	Credits
Required Courses		
MICRO 550	Current Topics in Virology	1
MICRO 581	Immunology A: Basic Concepts in Innate and Adaptive Immunity	1
MICRO 582	Immunology B: Adaptive Immunity	1
BMS 566	Viral Oncogenesis	1
BMS 564	Concepts in Virology	2
BMS 567	Viral Pathogenesis	1
MICRO 560	Concepts in Immunology	2
MICRO 572	Literature Reports	1
MICRO 590	Colloquium	1
At least 2 credits of 500-level elective courses selected in consultation with the student's thesis adviser and thesis committee.		2
Total Credits		13

Degree Requirements for the Ph.D.

In addition to the 17 credits of required BMS Core Courses for the Ph.D. degree, students pursuing the Ph.D. degree in the VIRIM Option must take:

Code	Title	Credits
Required Courses		
MICRO 550	Current Topics in Virology	1
MICRO 581	Immunology A: Basic Concepts in Innate and Adaptive Immunity	1
MICRO 582	Immunology B: Adaptive Immunity	1
BMS 566	Viral Oncogenesis	1
BMS 564	Concepts in Virology	2
MICRO 560	Concepts in Immunology	2
BMS 567	Viral Pathogenesis	1
MICRO 572	Literature Reports	1
MICRO 590	Colloquium	1
At least 1 credit of a 500-level elective course selected in consultation with the candidate's dissertation adviser and Ph.D. committee.		1
Total Credits		12

Dual-Titles

Dual-Title Ph.D. in Biomedical Sciences and Clinical and Translational Sciences

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Potential dual-title students can express an interest in the dual-title program as early as during the recruitment process for the BMS Graduate Program. Students must apply and be admitted to the graduate program in BMS and the Graduate School before they can apply for admission to the dual-title Ph.D. in Clinical and Translational Sciences (CTS). Refer to the Admission Requirements section of the Clinical and Translational Sciences Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/clinical-translational-sciences/>). Students must apply and be

admitted to the dual-title program in CTS prior to taking the qualifying exam.

Degree Requirements

To qualify for the dual-title degree in Biomedical Sciences and Clinical and Translational Sciences, students must satisfy the BMS Ph.D. degree requirements listed on the Degree Requirements tab. In addition, students pursuing the dual-title Ph.D. in BMS and CTS must complete the degree requirements for the dual-title CTS Ph.D., listed on the CTS Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/clinical-translational-sciences/>). Up to 7 credits for the Ph.D. degree in BMS that overlap with the CTS elective requirements can be counted toward the CTS dual-title.

The choice of CTS electives is subject to approval by the student's academic adviser(s) from the BMS and CTS programs. The electives should complement the student's work in BMS. A list of approved electives is maintained by the CTS program office.

The qualifying examination contains elements of both BMS and CTS. In accordance with Graduate Council policy, the qualifying examination committee must include at least one member of the CTS Graduate Faculty. Faculty with graduate appointments in both programs may serve in a combined role. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee must include at least one member of the CTS Graduate Faculty. Faculty members who hold appointments in the Graduate Faculty of both programs may serve in a combined role. If the chair of the Ph.D. committee is not a member of the Graduate Faculty in CTS, the member of the committee representing CTS must be appointed as co-chair. The fields of BMS and CTS will be integrated in the student's comprehensive exam, and the Ph.D. committee member representing CTS is responsible for insuring coverage of information relevant to the CTS field of study.

The candidate must complete a dissertation on a topic that reflects their original research and education in both BMS and CTS. To earn the dual-title Ph.D. degree, the dissertation must be accepted by the Ph.D. committee, the chair of the graduate program, and the Graduate School, and the student must pass a final oral examination (the dissertation defense).

Joint Degrees

Joint M.D./Ph.D. with the College of Medicine

Requirements listed here are in addition to requirements listed in GCAC-211 Joint Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-211-joint-degree-programs/>).

Admission Requirements

Prospective students interested in simultaneously pursuing a M.D. and Ph.D. degree must apply to the College of Medicine M.D. program using the national American Medical College Application Service (AMCAS) application system and indicate their intent to pursue the joint-degree program. Applicants must also meet the admission requirements of the Graduate School and the Ph.D. admission requirements listed on the Admission Requirements tab, however, GRE scores are not

required. The M.D./Ph.D. Admissions Committee reviews applications and evaluates candidates for acceptance into both the M.D. and Ph.D. programs. After the review committee has accepted an applicant to the joint degree program, s/he must apply to the Graduate School (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>) for admission to the graduate program. Students must be admitted to the joint degree program prior to taking the first course they intend to count towards the graduate degree. Applicants not accepted into the joint-degree program may be referred to either the M.D. or Ph.D. program, depending on their qualifications.

Applicants to this program generally have very strong grades and MCAT scores, as well as a strong and sustained background in research. Applicants must be able to clearly articulate reasons for pursuing the joint degree. Letters of recommendation from faculty who have advised the applicant in research and who can comment on the applicant's passion and potential for research are strongly encouraged.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree. Degree requirements for the M.D. program are listed on the Penn State College of Medicine website (<http://www.med.psu.edu/web/md/home/>). If students accepted into the joint degree program are unable to complete the M.D. degree, they are still eligible to receive the Ph.D. degree if all the Ph.D. degree requirements have been satisfied.

During the first two years of medical school, the student conducts at least three research rotations. After successful completion of the first two years of medical school the student enters the BMS Graduate Program and may be admitted to one of its options.

During the summer after the second year of medical school M.D./Ph.D. students take Step 1 of the United States Medical Licensing Examination (USMLE), which serves as the qualifying examination for the BMS Graduate Program.

In addition to the requirements for the Ph.D. committee (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>) for a Ph.D. student in the BMS Graduate Program, at least one member of the Ph.D. committee must be on the M.D./Ph.D. Steering Committee. This member may serve other roles on the Ph.D. committee.

M.D./Ph.D. students must complete 28 credits:

Code	Title	Credits
Required Courses		
8 credits from the first two years of medical school will be double-counted towards the Ph.D., replacing the following required core courses:		8
BMS 502	Cell and Systems Biology	
BMS 503	Advanced Molecular Genetics	
BMS 596	Individual Studies	
In addition to the curriculum of the first two years of medical school at the Penn State College of Medicine, all M.D./Ph.D. students in the BMS Graduate Program take the following core courses:		
BMS 506A	Biological Basis of Human Health and Disease A	2
BMS 506B	Biological Basis of Human Health and Disease B	2
BMS 512	Data Analysis For The Biomedical Laboratory Scientist, A Practical Approach	2
BMS 590	Colloquium	4

BMS 591	Biomedical Research Ethics	1
BMS 801	Writing Grant Proposals for Biomedical Research	1
In addition, students must take 2 credits of Colloquium or Journal Club, which is fulfilled by taking any of the following:		2
BICHEM 590	Colloquium	
PSIO 501	Scientific Analysis and Presentation	
PHARM 590	Colloquium	
MICRO 590	Colloquium	
MICRO 572	Literature Reports	
NEURO 590	Colloquium	
VIRIM 580	Critical Reading in Immunobiology	
At least 6 elective credits of 500-level elective courses selected in consultation with the student's dissertation adviser and Ph.D. committee.		6
Total Credits		28

The M.D./Ph.D. candidate prepares a written comprehensive examination in the format of a grant application and gives an oral presentation of this proposal to their Ph.D. committee.

A dissertation must be prepared and defended by each M.D./Ph.D. candidate. The dissertation must be accepted by the Ph.D. committee, the chair of the graduate program, and the Graduate School, and the student must pass a final oral examination (the dissertation defense). Students are required to have at least one first-author publication accepted or published based on their dissertation research prior to the final oral examination.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Biological Chemistry (BCHEM) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/bchem/>)

Biomedical Sciences (BMS) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/bms/>)

Genetics (GENET) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/genet/>)

Microbiology (MICRO) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/micro/>)

Pharmacology (PHARM) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/pharm/>)

Physiology (PSIO) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/psio/>)

Virology (VIRIM) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/virim/>)

Learning Outcomes

Master of Science (M.S.)

1. **Know:** Graduates will demonstrate a) a broad base of the biological knowledge and concepts required to understand the molecular, cellular, and organismal processes related to biomedical sciences; b) a broad understanding of experimental approaches used to investigate biomedical problems; c) specific knowledge within their area of research interest, and d) the highest standards of research ethics.
2. **Apply/Create:** Graduates will participate in the development of experimental approaches to test hypotheses and ideas of current relevance to their research interests.
3. **Apply/Create:** Graduates will perform experiments that address current problems in biomedical sciences leading to rigorous and reproducible outcomes.
4. **Think:** Graduates will begin developing skills to evaluate experimental approaches and results of their research.
5. **Communicate:** Graduates will convey ideas, experimental approaches, and results in clear and concise oral and written formats.
6. **Professional Practice:** Graduates will collaborate in a collegial and ethical manner with other professionals within their field.
7. **Professional Practice:** Graduates will evaluate potential careers to pursue following graduation and choose their specific career interest(s).

Doctor of Philosophy (Ph.D.)

1. **Know:** Graduates will demonstrate a) a broad base of the biological knowledge and concepts required to understand the molecular, cellular, and organismal processes related to biomedical sciences; b) a broad understanding of experimental approaches used to investigate biomedical problems; c) in-depth knowledge within their

specific areas of research interests, and d) the highest standards of research ethics.

2. **Apply/Create:** Graduates will creatively synthesize theory and literature to generate questions, ideas, or hypotheses addressing current problems in human health and disease, and will devise critical experimental approaches to test these ideas and hypotheses.
3. **Apply/Create:** Graduates will perform independent and original research studies that address current problems in biomedical sciences leading to rigorous and reproducible experimental outcomes.
4. **Think:** Graduates will critically evaluate experimental approaches and results of their own research and the research of others.
5. **Communicate:** Graduates will convey ideas, experimental approaches, and results in clear, concise, well-organized papers, posters, proposals, oral presentations, and discussions.
6. **Professional Practice:** Graduates will collaborate in a collegial and ethical manner with other professionals within their field or with diverse scientific backgrounds.
7. **Professional Practice:** Graduates will evaluate potential careers to pursue following graduation and choose their specific career interest(s).

Contact

Campus	Hershey Med Ctr
Graduate Program Head	Lisa M Shantz
Program Contact	Kristin E Smith H170, College of Medicine 500 University Drive Hershey PA 17033 kec17@psu.edu (717) 531-1045
Program Website	View (http://med.psu.edu/biomedical-sciences-phd/)

BMS Program Director: Lisa Shantz

Biochemistry, Genetics, and Genomics Option Director: Thomas Spratt

Cancer Biology Option Director: Douglas Stairs

Cellular and Integrative Physiology Option Director: Lisa Shantz

Translational Therapeutics Option Director: Yuval Silberman

Virology and Immunology Option Director: Joseph Wang

BioRenewable Systems

Graduate Program Head	Suat Irmak
Program Code	BRS
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Dual-Title M.S. and Ph.D. in Biorenewable Systems and International Agriculture and Development Dual-Title M.S. and Ph.D. in Biorenewable Systems and Operations Research
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=BRS)

Biorenewable systems are the structures and processes that create and support sustainable biologically-based products capable of being continuously replaced through sound technology and management. The BioRenewable Systems (BRS) degree is offered as a resident instruction, research-based M.S. and Ph.D. programs. The degree requires a thesis at both levels.

The BRS graduate program encompasses renewable biologically-based materials, products, and processes and fully integrates scientific research with the principles of systems technology, business, management, marketing, leadership development, and entrepreneurship. Toward that end, the academic requirements for BRS are closely related to the disciplinary focus of agricultural and biological sciences, technological innovation and application, and business, management, and leadership within the continually evolving biobased sectors. This multidisciplinary aspect makes BRS unique from other fields of science and management. To promote and fulfill this uniqueness, the continuation of courses in science, business, management, and technology at the graduate level is encouraged and expected.

Excellent facilities, including equipment and instrumentation, are available for research in the designated areas. Collaborative arrangements allow access to a large variety of other resources:

- Materials Research Institute;
- Penn State Institutes of the Energy and Environment;
- Huck Institutes of the Life Sciences;
- Housing Research Center;
- USDA Pasture Systems and Watershed Management Research Lab;
- a mushroom research and demonstration facility;
- and a 1,500-acre agricultural research center for cooperative work with agronomic and horticultural production systems as well as animal production systems.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

All applicants must provide official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>), a statement of purpose written by the applicant, and at least three letters of recommendation. Admission into the BRS Graduate Program is based upon a thorough review of all applicant qualifications, and the best-qualified applicants will be accepted up to the number of students for which program resources are available. GRE scores will not be accepted.

Master of Science (M.S.)

Completion of a relevant undergraduate Bachelor degree program is required for admission to the M.S. degree program; relevant programs span a diverse set of academic disciplines, including but not limited to: Agricultural Sciences, Biology, Chemistry, Business, Engineering, and Environmental Sciences. Students with junior-senior GPA of at least 3.00 (4.00 base) will be competitive in the admission process.

Doctor of Philosophy (Ph.D.)

The program requirement for acceptance to graduate study toward a Ph.D. degree in BRS is typically an M.S. degree with research thesis in BRS or related discipline such as: Agricultural Sciences, Biology, Chemistry, Business, Engineering, and Environmental Sciences, or with a B.S. degree in Agricultural Systems Management (ASM) or BRS or equivalent. Outstanding students interested in direct admission from a B.S., B.A., or M.B.A. program to the Ph.D. Program should contact the Graduate Program Coordinator for further clarification and details. Direct admission will be based on critical evaluation of the student's:

- potential to conduct publishable research,
- academic record,
- an additional language (other than the student's mother tongue),
- performance on standardized tests,
- statement of purpose,
- and reference letters.

Students who apply directly to the Ph.D. program with a B.S. degree and are deemed by the admissions committee not to meet the standards for admission to the Ph.D. program may be considered either for admission into the M.S. program or for admission to the Ph.D. program on a provisional basis (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/provisional-admission/>). The student will remain in provisional status in the Ph.D. program until completing the suggested provisional courses with a minimum grade-point average of 3.00. For provisional status to change, the suggested provisional courses must be completed within the first two semesters of study.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

All candidates for the M.S. degree must:

- prepare and complete a thesis
- complete a minimum of 30 credits at the 400, 500, 600, or 800 level (including a minimum of 18 credits at the 500 and 600 level, combined, and a minimum of 6 credits of research)
- obtain a minimum grade-point average of 3.00.

Only courses in which grades of C or better are earned may be counted toward the requirements of the master's degree. Each program must include:

Code	Title	Credits
Required Courses		
BRS 500	Research Methods	3
BRS 502	Human Behavior and ethics in Management and Technology (or other Ethics course from a list of approved courses maintained by the program office, unless previously taken)	3
BRS 504	Biorenewable Systems Analysis	3
BRS 590	Colloquium	3
Electives		
Two courses from list of electives maintained by the program office		6
At least one 5XX statistics course		3
Additional 4XX or 5XX course or BRS 600 Thesis Research		3
Culminating Experience		
BRS 600	Thesis Research	6
Total Credits		30

Doctor of Philosophy (ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Official entrance into a Ph.D. program occurs upon successful completion of the Ph.D. Qualifying Examination. Ph.D. degree requirements include successful completion of the following:

- approved graduate course work,
- Ph.D. language and communication requirements,
- a comprehensive examination,
- and defense, approval, and submission of a dissertation.

No University-level (Graduate Council) minimum number of courses completed or credits earned are specified for the Ph.D.; the student's Ph.D. committee will recommend the minimum requirements as appropriate for each individual student's program of study and dissertation research. Unless previously taken for the M.S., each Ph.D. student must complete:

Code	Title	Credits
Required Courses		
BRS 500	Research Methods	3
BRS 502	Human Behavior and ethics in Management and Technology (or other Ethics course from a list of approved courses maintained by the program office, unless previously taken)	3
BRS 504	Biorenewable Systems Analysis	3
BRS 590	Colloquium	4

BRS 602	Supervised Experiences in College Teaching (at least 1 credit)	1-3
Communications or International Language/Culture		3
In addition the candidate must complete 6 credits of BRS 5XX (excluding BRS 500 and 590-596) or select from a list maintained by the program office		6

The candidate is expected to develop a program of study and submit it to the appointed Ph.D. committee for consideration and approval. All requirements for a Ph.D. degree, whether satisfied on this campus or elsewhere, must be completed within eight years after passing the qualifying examination.

Qualifying Examination

The Ph.D. Qualifying Examination Committee will administer the Qualifying Examination. This committee will consist of four BRS graduate faculty members, including the Adviser, the ABE Department Head (or annually appointed designee), the BRS Graduate Program Coordinator, and one faculty member selected by the student. In cases where a member serves two roles on the committee, an additional member will be appointed by the Graduate Program Coordinator. The Qualifying Examination will consist of developing a Ph.D. research proposal following the completion of BRS 500, presenting the proposal, and defending/discussing the proposed research with the Committee. The Qualifying Examination will be completed by the student soon after they have completed at least 18 credits but before the end of the third semester. Successful completion of the Qualifying Examination does not mean that the student's Ph.D. research proposal is approved. Rather, final approval of the candidate's research proposal will be the responsibility of the Ph.D. committee.

Ph.D. Committee

The Ph.D. committee must meet all of the Graduate Council requirements (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), and:

1. the chairperson and at least one other member must be BRS Graduate Faculty members,
2. at least one member must be from a department other than ABE and s/he should be a Graduate Faculty member of a program other than BRS,
3. at least one member must represent any minor department(s) if the student selects a minor(s), and
4. the Ph.D. committee can be appointed only after the Qualifying Examination has been passed.

Ph.D. Language and Communication Requirement

The purpose of the communication requirement is to strengthen the student's professional communication skills. The candidate must take a minimum of one three-credit course and receive a grade of B or better. Course selections must be approved by the academic adviser prior to registration. Courses used to satisfy this requirement must include the substantial practice of writing and/or speaking.

Comprehensive Examination

When a Ph.D. candidate has substantially completed the course work, including the communication requirements, s/he is required to take a Comprehensive Examination covering the major, minor, and related areas of study. The Comprehensive Examination will be both written and oral. The nature and details of the Comprehensive Examination will be determined by the student's Ph.D. committee. In general, the student will be required to demonstrate ability to synthesize information

acquired through formal coursework and to use technical literature to find information required for solving biorenewable systems problems. A favorable vote of at least two-thirds of the committee is required for passing. If a candidate fails, the committee will determine whether another examination may be taken.

Final Oral Examination

Upon recommendation of the Adviser, a Ph.D. candidate who has satisfied all other requirements for the degree will be scheduled to take a Final Oral Examination. The student must be registered appropriately for the semester in which the Final Oral Examination is taken. This examination is open to the public and the student should notify all departmental faculty and graduate students. The examination is related largely to the dissertation, but may cover the candidate's entire field of study without regard to courses that have been taken either at Penn State University or elsewhere. The defense of the dissertation should be well-prepared including any appropriate visual aids. One of the aims of the preparation should be to synthesize the important conclusions in a time-efficient presentation, leaving ample time for questions and discussion. A favorable vote of at least two-thirds of the committee is required for passing. If a candidate fails, the committee will determine whether another examination may be taken.

Dual-Titles

Dual-Title M.S. and Ph.D. in BioRenewable Systems and International Agriculture and Development

Admission Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Students must apply and be admitted to the graduate program in BioRenewable Systems and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the INTAD dual-title program. Refer to the Admission Requirements section of the INTAD Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/international-agriculture-development/>). Doctoral students must be admitted into the dual-title degree program in INTAD prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in BioRenewable Systems. In addition, students must complete the degree requirements for the dual-title in INTAD, listed on the INTAD Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/international-agriculture-development/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from BioRenewable Systems and must include at least one Graduate Faculty member from the INTAD program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both BioRenewable Systems and INTAD. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>), the Ph.D. committee of a BioRenewable Systems and INTAD dual-title Ph.D. student must include at least one member of the INTAD Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in INTAD, the member of the committee representing INTAD must be appointed as co-chair. The INTAD representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in BioRenewable Systems and INTAD. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title M.S. and Ph.D. in BioRenewable Systems and Operations Research

Admission Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Students must apply and be admitted to the graduate program in BioRenewable Systems and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the OR dual-title program. Refer to the Admission Requirements section of the Operations Research Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/operations-research/>). Doctoral students must be admitted into the dual-title degree program in OR prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree in which they are enrolled (BioRenewable Systems). In addition, students must complete the degree requirements for the dual-title in OR, listed on the Operations Research Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/operations-research/>).

Students in the Master's dual-title program are required to write and orally defend a thesis on a topic that is approved in advance by their M S Advisory Committee and reflects their research and education in BioRenewable Systems and Operations Research. Upon completion of the Master's thesis, the student must pass a final oral examination (the thesis defense) to earn the Master's degree. The thesis must be accepted by the student's M S Advisory Committee, the head of the graduate program, and the Graduate School. The student's thesis supervisor must be a member of the Graduate Faculty recommended by the chair of the program granting the degree and approved by the Operations Research committee as qualified to supervise thesis work in operations research.

Students in the doctoral dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by

their Ph.D. committee and reflects their original research and education in BioRenewable Systems and Operations Research. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School. The qualifying examination committee for the dual-title Ph.D. degree must include at least one Graduate Faculty member from the Operations Research program. The chair and at least two members of the Ph.D. committee of an Operations Research dual-title Ph.D. student must be members of the Operations Research Graduate Faculty.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Biorenewable Systems (BRS) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/brs/>)

Learning Outcomes

Master of Science (M.S.)

1. **KNOW:** Graduates will demonstrate knowledge of sustainable, renewable biologically-based systems including their life-cycle assessment and technoeconomic analyses.
2. **THINK:** Graduates will be able to critically and creatively conceptualize and evaluate biorenewable industry problem formulations, analyses, and solutions.
3. **APPLY/CREATE:** Graduates will demonstrate proficiency in biorenewable industry problem formulation, planning, organization and implementation of appropriate methods of analyses and solutions.
4. **COMMUNICATE:** Graduates will be able to effectively communicate technical knowledge, including ideas, data analysis, findings, or decision justification in written and oral presentation appropriate to the audience.
5. **PROFESSIONAL PRACTICE:** Graduates will be able to apply analytical skills for effective decision making in the biorenewable resource industries. Graduates will demonstrate a knowledge of ethics, equity, diversity and inclusivity and the application of these concepts and principles to the profession.

Doctor of Philosophy (Ph.D.)

1. **KNOW:** Graduates will demonstrate knowledge of sustainable, renewable biologically-based systems, including their life-cycle assessment and technoeconomic analyses.
2. **APPLY/CREATE:** Graduates will demonstrate knowledge of one or more of the following: technologies and systems analysis, science, safety, marketing, business, or management principles and methodologies as they pertain to biorenewable systems.
3. **APPLY/CREATE:** Graduates will be able to communicate, both orally and in-writing, business and/or technical concepts within the context of biorenewable industries. Graduates will be able to analyze and interpret data and demonstrate an ability to draw sound conclusions from data.
4. **THINK:** Graduates will be able to independently analyze and critique motivations for conducting research, the research process, research results, and the implications of research and its results to our world.
5. **COMMUNICATE:** Graduates will be able to actively listen, convey accurately and clearly ideas and results both orally and in writing, and engage in positive, effective deliberation.
6. **PROFESSIONAL PRACTICE:** Graduates will be prepared to become leaders in our society by being able to apply the skills acquired to engage in effective decision making in the operations and/or management of biorenewable resource industries. Graduates will demonstrate a knowledge of ethics, equity, diversity and inclusivity and the application of these concepts and principles to the profession.

Contact

Campus	University Park
Graduate Program Head	Suat Irmak
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Ali Demirci
Program Contact	Kristen C. Greskovic 105 Agricultural Engineering Building University Park PA 16802 kcg107@psu.edu (814) 863-1524
Program Website	View (http://abe.psu.edu/graduateprograms/)

Biostatistics

Graduate Program Head	Cheryl Thompson
Program Code	BIOST
Campus(es)	Hershey (Ph.D.)
Degrees Conferred	Doctor of Philosophy (Ph.D.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=BIOST)

Biostatistics is the science that applies statistical theory and mathematical principals to research in medicine, biology, environmental science, public health, and related fields. Biostatisticians working in the area of public health develop and use mathematical and scientific methods to:

1. determine risk factors for disease and injuries, and
2. identify health trends within communities.

Biostatisticians working in the area of medicine develop and use mathematical and scientific methods to design and analyze:

1. clinical trials to investigate new therapies for treating acute and chronic illness,
2. observational studies to understand disease onset and progression,
3. basic science studies to determine the mechanisms of disease, and
4. human genetics studies to investigate the inherited susceptibility to disease.

Career opportunities are available in universities, academic medical centers, government, and private industry. The demand for individuals with graduate-level degrees in biostatistics is extremely high.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/>)

[gcac-300/gcac-305-admission-requirements-international-students/](#)) for more information.

Applicants must complete prior to admission:

1. A two-semester graduate-level course in applied statistics from a recognized graduate program. The comparable courses offered by the Department of Statistics are STAT 511 and STAT 512.
2. A two-semester graduate-level course in mathematical statistics from a recognized graduate program. The comparable courses offered by the Department of Statistics are STAT 513 and STAT 514.

Prospective applicants must demonstrate:

3. For admission to the Graduate School, all applicants must have received from a regionally accredited institution a baccalaureate degree earned under residence and credit conditions substantially equivalent to those required by Penn State. International applicants must hold the equivalent of an American four-year baccalaureate degree.
4. Results from one of the following standardized tests taken within the past five (5) years:
 - a. Graduate Record Examination (GRE)
 - b. Graduate Management Admission Test (GMAT)
 - c. Medical College Admission Test (MCAT)
 - d. Law School Admission Test (LSAT)
 - e. (This requirement is waived for applicants who have an advanced degree in a related field beyond the baccalaureate.)
5. Completion of the Graduate School application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>), which includes three (3) letters of recommendation and a Curriculum Vitae or resume.
6. Payment of the application fee.
- 3.

Degree Requirements

Doctor of Philosophy

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Each student in the Biostatistics Ph.D. program is expected to acquire knowledge in the disciplines of Biostatistics.

Each student must complete a total of 31 credits of graduate level course work, the majority of which are 500 level courses, specifically:

- 22 credits in required courses
- 6 additional credits in Epidemiology or Health Services Research
- 3 credits in elective courses, plus
- Dissertation

After the completion of the first year of course work, each student is required to take a qualifying examination, based on the coursework in PHS 523, PHS 524, PHS 525, PHS 526 and PHS 527. The decision to allow the student to continue in the program will be made by a committee of Graduate Faculty in the Biostatistics program. In addition, a comprehensive examination is administered at the completion of all course work, followed by the final oral examination in defense of the Ph.D. dissertation.

Courses

Code	Title	Credits
Required Courses		
PHS 500	Research Ethics for Clinical Investigators	1
PHS 523	Multivariate Analysis	3
PHS 524	Longitudinal Data Analysis	3
PHS 526	Categorical Data Analysis	3
PHS 527	Survival Analysis	3
PHS 528	Bayesian Methods	3
PHS 580	Clinical Trials: Design and Analysis	3
STAT 553	Asymptotic Tools	3
Select 6 credits of the following:		6
PHS 535	Quality of Care Measurement	
PHS 536	Health Survey Research Methods	
PHS 550	Principles of Epidemiology	
PHS 551	Advanced Epidemiological Methods	
PHS 552	Molecular Epidemiology of Chronic Disease	
PHS 570	Health Economics and Economic Evaluation	
Electives		
Select 3 credits of the following:		3
PHS 516	Statistical Genetics	
STAT 561	Statistical Inference I	
STAT 562	Statistical Inference II	
Total Credits		31

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Public Health Sciences (PHS) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/phs/>)

Contact

Campus	Hershey Med Ctr
Graduate Program Head	Cheryl Thompson
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Arthur Berg
Program Contact	Justine Shultz PO Box 855 90 Hope Drive Hershey PA 17033-0855 jes5437@psu.edu (717) 531-0003 Ext. 287460
Program Website	View (http://med.psu.edu/biostatistics-phd/)

Biotechnology

Graduate Program Head	Santhosh Girirajan
Program Code	BIOT
Campus(es)	University Park (M.BIOT.)
Degrees Conferred	Master of Biotechnology (M.BIOT.) Integrated B.S. in Biotechnology and M.BIOT. in Biotechnology
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=BIOT)

The Master of Biotechnology degree program is offered through a collaboration of the Department of Biochemistry and Molecular Biology and the Huck Institutes of the Life Sciences. It is a multidisciplinary program involving faculty members from different academic departments in Penn State University as well as ad hoc mentors from the academic faculty and from industry.

The Master of Biotechnology curriculum is designed to give students broad knowledge and training in the scientific and practical aspects of biotechnology. It involves innovative, hands-on, and multidisciplinary learning approaches to educate and train students in the science behind biotechnology, its business and legal aspects, and the ethical and social issues that it brings about. In addition, the courses and the activities required of all students in this program develop transferable professional skills such as team-working and communication skills, which are very important in industry in particular.

Graduates of this program are expected to have the knowledge and training for diverse career options: as academic educators, as scientists in both academic and industry settings, as members of decision-making business and management teams in government and biotechnology industries, as bioentrepreneurs, and as members and leaders of

governmental, public, and private organizations that deal with social, ethical and legal issues in biotechnology. Because of their broad knowledge in biotechnology, graduates of this program are expected to fill a niche in industry where knowledge and ability to interface and communicate with various functional groups within the organization are required.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The program is appropriate for students with a baccalaureate degree in biological sciences, chemistry, or engineering or other baccalaureate degrees that include sufficient credits from relevant courses in the life sciences. Applicants must have a minimum junior/senior grade point average of 3.00 (on a 4.00 scale). Graduate Record Examinations (GRE) scores are not required. Typically, students are admitted as part of a cohort to commence studies in the Fall. The best-qualified applicants will be accepted up to the number of spaces available for new students.

Degree Requirements

Master of Biotechnology

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

A minimum of 30 credits at the 400, 500, or 800 level is required for completion of the degree, 18 credits of which must be from courses in the 500 or 800 level, with a minimum of 6 credits at the 500 level. Students are required to take 16 to 18 credits from core courses listed below. Additional credits are from industry internship or cooperative education (co-op) and elective courses. A list of approved elective courses is maintained by the graduate program office. All Master of Biotechnology candidates are required to write a research paper based on a research project conducted in an academic, government, or industry research laboratory as the culminating experience for the degree. The research paper is completed while the student is enrolled in MCIBS 594.

Code	Title	Credits
Required Courses		
BMB 400	Molecular Biology of the Gene	3
BIOTC 479	Methods in Biofermentations	3
or BE 468	Microbiological Engineering	
MCIBS 571	Current Issues in Biotechnology	2
MCIBS 590	Colloquium	2
MCIBS 591	Ethics, Rigor, Reproducibility and Conduct of Research in the Life Sciences	2
MCIBS 593	Molecular Biology Laboratory	3
Electives ¹		
Culminating Experience		
MCIBS 594	Research Topics	3-6

¹ These courses are chosen from offerings in various academic departments based on students' interest or track and career objectives. These also include MCIBS 595 (Internship) and any 596 (Individual Studies) course under a faculty member whose research relates to

a student's area of interest. A list of approved elective courses is maintained by the graduate program office.

Integrated Undergrad-Grad Programs

Integrated B.S. in Biotechnology and M.BIOT. in Biotechnology

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Biotechnology with the M.Biot. in Biotechnology offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- University Park

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The integrated B.S. in Biotechnology-Master of Biotechnology degree program is designed to enable qualified undergraduate students in the B.S. Biotechnology program to graduate in five years with the Master of Biotechnology degree.

Admission Requirements

Students must apply to the program via the Graduate School application for admission (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet all the admission requirements of the Graduate Council, listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>), and the Biotechnology graduate program for the Master of Biotechnology degree, listed on the Admission Requirements tab.

Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. Students must have a GPA of 3.5 at the time of application to the integrated degree program when they have completed at least 75 credits of their B.S. curriculum at the time of their admission to the integrated degree program.

In consultation with an adviser, students must prepare a plan of study appropriate to this integrated program, and must present their plan of study to the head of the graduate program or the appropriate committee overseeing the integrated program prior to being admitted to the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.

Degree Requirements

Student must fulfill all degree requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Science in Biotechnology

are listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>). Degree requirements for the Master of Biotechnology in Biotechnology degree are listed on the Degree Requirements tab of this bulletin.

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.BIOT. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
BMB 400	Molecular Biology of the Gene	2-3
BIOTC 479	Methods in Biofermentations	3
or BE 468	Microbiological Engineering	
MCIBS 571	Current Issues in Biotechnology	2
MCIBS 590	Colloquium	1-3
MCIBS 591	Ethics, Rigor, Reproducibility and Conduct of Research in the Life Sciences	2
MCIBS 593	Molecular Biology Laboratory	3

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's

website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Elective courses may be taken from chosen from offerings in various academic departments based on students' interest or track and career objectives

Graduate Courses List (<https://bulletins.psu.edu/university-course-descriptions/graduate/>)

Learning Outcomes

1. **KNOW.** Students will be able to demonstrate conceptual and practical knowledge of the broad aspects of biotechnology: the core areas in science and the technologies that drive progress in biotechnology, the business, intellectual property, regulatory, legal, social and ethical aspects of the biotechnology industry; students will also be able to show practical understanding of the professional skills vital to employment and career success in biotechnology.
2. **APPLY/CREATE/THINK.** Students will be able to demonstrate critical review of scientific literature, proficiency in the conduct of scientific research independently or in a team setting, as well as in non-bench research-related responsibilities in broad areas of biotechnology as necessary. Students will also demonstrate adequate professional preparation for competitive curricular employment (internships and cooperative education or co-op) and entry-level employment post-degree.
3. **COMMUNICATE.** Students will demonstrate skills in communicating scientifically through group work, research papers and oral presentations, and professionally through networking, interviews, resumes or curriculum vitae (CVs), and other required career-related activities.
4. **PROFESSIONAL PRACTICE.** Students will demonstrate knowledge of interpersonal workplace dynamics, the ability to perform in a team environment and adapt to a very dynamic biotechnology workplace, participation in professional networking, and engagement in professional activities and organizations serving the discipline and the industry.

Contact

Campus	University Park
Graduate Program Head	Santhosh Girirajan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Natasha N Tirko
Program Contact	Freya Heryla Huck Institutes of the Life Sciences 101 Life Sciences Building University Park PA 16802 fqh5144@psu.edu (814) 863-3273
Program Website	View (https://www.huck.psu.edu/graduate-programs/master-of-biotechnology/)

Business Administration (Behrend)

Graduate Program Head	Greg Filbeck
Program Code	BADM
Campus(es)	Erie (M.B.A.)
Degrees Conferred	Master of Business Administration (M.B.A.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=BADM)

The Penn State Behrend M.B.A. is an AACSB International-accredited general degree emphasizing development of the planning and problem-solving skills crucial in middle and upper management. Course work emphasizes the integration of business functions and the practical application of theory in the business world using cases, simulated problems, and actual situations students are experiencing at work. Many students are fully employed professionals who bring a wealth of knowledge and experience to the classroom. The program is delivered in a blended format of 25 percent face-to-face instruction on campus or at the Regional Learning Alliance in Cranberry Township and 75 percent online learning. The great majority of our students complete the program on a part-time basis in under two years.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Admission cannot be granted to individuals who require a student visa due to the majority of instruction taking place online.

Admission is granted only to candidates who demonstrate high promise of success for graduate work.

Admission decisions are based on the following:

- undergraduate grade-point average;
- the degree of correspondence between the applicant's objectives and those of the program; and
- three letters of reference.

Favorable consideration will be given to applicants who have significant work experience. Applications are processed on a rolling basis with admission to the program granted in both the fall and the spring semesters.

Degree Requirements

Master of Business Administration

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The Master of Business Administration degree program consists of two parts:

Demonstration of Subject Matter Competence

Students are expected to demonstrate fundamental competence in accounting, finance, economics, management, marketing, operations management, and statistics prior to taking the Required Courses. Applicants who have, within seven years prior to the date of their admission to the degree program, completed a baccalaureate degree in business from a regionally accredited institution that includes introductory courses in these disciplines will be considered to have demonstrated competence as long as the previously completed courses carry grades of B or higher. An applicant who, within seven years prior to his or her admission to the degree program, completed a baccalaureate degree in a non-business field from a regionally accredited institution that includes equivalent undergraduate or graduate courses carrying a grade of B or higher will also be considered to have demonstrated competence. Applicants who attained currency of knowledge through relevant business experience or continuing professional education in one or more of the subject areas may demonstrate competence through examination.

Required Course work

These courses provide greater depth of knowledge in the subject areas included. This component of the MBA program consists of seven 3-credit courses that cover advanced topics in cost management, managing effective organizations, quantitative methods for business, leadership and ethics, corporate finance, marketing strategy, and strategic management and business policy.

All students are required to complete the following courses unless they can demonstrate advanced knowledge of the course subject matter through prior course work, extensive experience and/or advanced professional education. Students who believe they have knowledge of a required course must submit a written request and documentation describing their knowledge of the course subject matter. If approved, the student will substitute an additional elective course for the required course.

Code	Title	Credits
Required Courses		
BADM 510	Cost Management for Decision Making and Control	3
BADM 512	Managing Effective Organizations	3
BADM 513	Quantitative Methods for Business	3
BADM 526	Leadership and Ethics	3
BADM 532	Corporate Finance	3
BADM 554	Marketing Strategy	3
Electives ¹		9

Culminating Experience

BADM 514	Strategic Planning and Business Policy ²	3
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Total Credits **30**

¹ All students are required to take 9 credits of elective courses covering advanced topics of their choice. MBA students may apply a maximum of 6 credits of approved 400-level course work toward elective requirements. Course work at the 400 level must be approved by the director of the MBA program and cannot have been used for another degree.

² The program capstone is BADM 514, which is a semester long industry and business analysis problem, culminating in a final, integrated paper.

Transfer Credits

Credits earned at other institutions but not used to earn a degree may be applied toward the requirements for a graduate degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>). Application of transfer credits to the student's academic program must be approved by the director of the MBA program.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

A limited number of scholarships and graduate assistantships are available. Many students work full time and take classes part time. In many cases, employers have a tuition-reimbursement plan paying for partial or full tuition. View student aid options (<https://behrend.psu.edu/admissions-financial-aid/financial-aid/incoming-students/graduate/>) available.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Business Administration (BADM) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/badm/>)

Learning outcomes

1. CRITICAL THINKING: Students will be able to apply critical thinking techniques to business situations to construct relevant analyses, arguments, and conclusions.
 - a. Students will clearly identify the key issues in the analysis.
 - b. Students will present the appropriate analytic framework or warrant.
 - c. Students will identify and assess important assumptions and question their validity.
 - d. Students will identify and assess the quality of supporting data/evidence & provides additional data/evidence related to the issue.
 - e. Students will draw and discusses conclusions, implications, and consequences.
2. WRITTEN COMMUNICATION: Students will be able to demonstrate effective writing skills.
 - a. Students will organize written assignments effectively
 - b. Students will develop a clear and well-structured argument
 - c. Students will identify and provide evidence sufficient to support the argument
 - d. Students will find reliable sources and cite and reference them correctly
 - e. Students will demonstrate proper writing mechanics with respect to spelling, punctuation, and grammar.
3. ETHICS: Students will be able to recognize ethical issues and apply ethical theories in business situations at individual and/or organizational levels
 - a. Students will identify ethical issues/inter-relationships between business and society
 - b. Students will identify stakeholders
 - c. Students will identify consequence of decisions/actions to stakeholders
 - d. Students will recognize the potential implications of managerial actions on employee ethical conduct
 - e. Students will analyze an ethical dilemma using multiple ethical principles
 - f. Students will correctly apply ethical principles
 - g. Students will recommend a course of action
 - h. Supports action plan recommendation with ethical analysis
4. FUNCTIONAL AREA KNOWLEDGE: Students will be able to apply foundational knowledge to analyze and solve problems and interpret written and visual material across various business domains.
 - a. Students will be able to apply foundational knowledge to analyze and solve problems and interpret written and visual material in the Marketing domain.

- b. Students will be able to apply foundational knowledge to analyze and solve problems and interpret written and visual material in the Management domain.
- c. Students will be able to apply foundational knowledge to analyze and solve problems and interpret written and visual material in the Finance domain.
- d. Students will be able to apply foundational knowledge to analyze and solve problems and interpret written and visual material in the Accounting domain.
- e. Students will be able to apply foundational knowledge to analyze and solve problems and interpret written and visual material in the Strategic Integration domain.

Contact

Campus	Erie
Graduate Program Head	Greg Filbeck
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Al Warner
Program Contact	Al Warner 5101 Jordan Road Burke Center Erie PA 16563 agw2@psu.edu (814) 898-6509
Program Website	View (http://psbehrend.psu.edu/admissions-financial-aid/graduate-admissions/master-of-business-administration/)

Business Administration (Capital)

Graduate Program Head	John Haddad
Program Code	BADMN
Campus(es)	Harrisburg (M.B.A.)
Degrees Conferred	Master of Business Administration (M.B.A.) Integrated B.S. in Accounting and M.B.A. in Business Administration Integrated B.S. in Finance and M.B.A. in Business Administration Integrated B.S. in Information Systems and M.B.A. in Business Administration Integrated B.S. in Management and M.B.A. in Business Administration Integrated B.S. in Marketing and M.B.A. in Business Administration Integrated B.S. in Project and Supply Chain Management and M.B.A. in Business Administration Joint J.D. / M.B.A. with Dickinson Law
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=BADMN)

The M.B.A. program is intended to provide graduates with a foundation for personal and professional growth and lifelong learning; a firm grounding in the academic disciplines underlying the field of business;

participative strengths; and decision making, problem solving, and critical thinking skills. Major emphasis is placed on the social, legal, and ethical context of business—particularly ethical values needed in the conduct of business. Program faculty place high value on teaching and currency of curriculum, an emphasis on oral and written communication, collaborative learning, and cross-functional integration of concepts.

The degree is offered in its entirety on the Penn State Harrisburg campus located in Middletown, PA. To provide flexibility for students, some courses are also offered online or in a hybrid format (i.e., a blend of resident instruction and online). Students should contact the program office for information on specific semester course offerings.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The admission decision is based on the applicant's entire admission portfolio consisting of:

- undergraduate degree,
- post baccalaureate course work,
- either the Graduate Management Admission Test (GMAT) or Graduate Record Examination (GRE) scores,
- professional experience,
- letters of recommendation,
- and statements provided in the application.

An applicant with significant work experience may be admitted with a lower GMAT or GRE score, while an applicant with limited work experience may be admitted with a higher GMAT or GRE score and an outstanding undergraduate background.

The GMAT or GRE requirement may be waived for the following applicants:

- Graduates from business, engineering, science, or related fields with a cumulative undergraduate GPA of at least 3.5 from accredited U.S. schools.
- Members of Beta Gamma Sigma, the international business honors society.
- Ph.D., J.D., M.D., or Master's degree holders in business, engineering, science, or related fields from accredited U.S. schools.

Please note that there is no GMAT or GRE waiver for applicants seeking graduate assistantships.

Please visit the GMAT website (<http://www.mba.com/us/>) or the GRE website (<http://www.ets.org/gre/>) for information about these examinations.

The candidate must apply for admission to the program via the Graduate School application for admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>). The applicant is required to submit:

- a completed online application form (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) with application fee

- official transcripts from all post-secondary institutions attended (<http://gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>)
- GMAT or GRE test scores (the test must have been taken within the past five years)
- two letters of recommendation
- resume

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Candidates may enter the program at the beginning of the fall or spring semester, or the summer session. To allow time for applications to be processed, all information, including the GMAT or GRE score, must be received by the admissions office no later than:

- Fall Semester - July 18
- Spring Semester - November 18
- Summer Session - April 18

Applicants from outside the United States must follow the early admission dates in order to allow the necessary clearances and paperwork to be processed in time. International application deadline dates are:

- Fall Semester—May 31
- Spring Semester—September 30
- Summer Session—February 28

To be considered for a graduate assistantship, applicants must submit a complete application by March 1. Students on graduate assistantships must adhere to the course load limits (<http://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Degree Requirements

Master of Business Administration (M.B.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Preparation for the Program

Credits obtained to fulfill program preparation and foundation courses cannot be applied towards the requirements for the degree.

Analytic Skills Requirement

Students must demonstrate competence in analytic skills. This requirement can be satisfied in one of two ways:

1. by satisfactory completion of a college-level mathematics course; or
2. by successful completion of a proficiency examination in mathematics approved by the M.B.A. program. This requirement must be satisfied by the first semester or summer session of the student's matriculation, and completed with a grade of C or higher.

Computer Skills Requirement

Students are required to demonstrate proficiency in the use of computer applications. This requirement can be satisfied through a college-level

computer applications course within the past five years with a grade of a B or higher, or by documented, significant, computer-related work experience. If this requirement has not been met prior to admission, a college-level computer course such as MIS 204 or CMPSC 203 is required. Course work must be completed by the first semester or summer session of the student's matriculation with a grade of B or higher.

Communications Skills Requirement

Successful completion of the M.B.A. program requires the ability to think clearly, and to write and speak persuasively. Part of this requirement can be satisfied by achieving a score of "4" or higher on the Graduate Management Admission Test (GMAT) or the Graduate Record Examination (GRE) Analytical Writing Assessment. If this score is not achieved, students must satisfy this requirement through additional course work in writing skills such as ENGL 202D or other work developed in consultation with the M.B.A. program. This requirement must be satisfied by the first semester or summer session of the student's matriculation. All courses taken must be completed with a grade of B or higher. The speech component of this requirement is satisfied through individual and group presentations in MNGMT 511 and other courses in the M.B.A. program.

Foundation Courses

The M.B.A. program is grounded in the academic disciplines of accounting, finance, economics, marketing, management, and information sciences, among others, in order to provide students with the conceptual foundation required for competent pursuit of more advanced studies in business administration as well as the ethical and legal management of profit and non-profit organizations. This background can be provided by course work taken at the graduate level or as part of a baccalaureate degree from a regionally accredited U.S. institution or a tertiary (post-secondary) degree that is deemed comparable to a four-year bachelor's degree from a regionally accredited U.S. institution. This degree must be from an officially recognized degree-granting institution in the country in which it operates. All courses must have been completed with a grade of B or higher, within seven years prior to admission to the M.B.A. program. Course work not meeting the tests of relevancy, quality, or currency must be taken at the graduate level prior to starting the relevant prescribed courses and electives. Time limits may be waived by the M.B.A. program on the basis of post-graduation training or current and relevant work experience. Courses available at Penn State Harrisburg that provide the necessary foundation for graduate business study include:

Code	Title	Credits
ACCT 501	Financial Statement Analysis	3
BUS 505	Data Analysis for Business Decisions	3
BUSEC 502	Economics for Managers	3
MNGMT 511	Organizational Behavior	3
MNGMT 522	Operations and Supply Chain Management	3
	or MNGMT 523 Service Operations Management	
MRKT 513	Marketing Management	3

M.B.A. Degree Requirements

The M.B.A. degree requires 30 credits of course work at the graduate level (500- or 800-level). These credits are distributed over two clusters of courses: Required Courses and Electives/Tracks.

Code	Title	Credits
Required Courses		
ACCT 540	Accounting for Managerial Decisions	3
BUS 510	Business Analytics and Decision Modeling	3
BUS 515	Business Ethics and Corporate Governance	3
FINAN 521 or FINAN 530	Corporate Finance Corporate Finance II	3
INFSY 540	Information Technology and Knowledge Management	3
MRKT 514	Strategic Mkt	3
Electives		
Select 9 credits ¹		9
Culminating Experience		
BUS 588	Strategic Management	3
Total Credits		30

The prescribed courses develop key competencies in functional areas of business and BUS 588, the required capstone course, integrates knowledge from all functional areas. The capstone project, completed while the student is enrolled in BUS 588, is a feasibility study incorporating firm-level business strategies leading to sustainable competitive advantage.

¹ Students may elect courses in clusters of "Tracks" organized around a common theme designed to be integrative and cohesive. The Tracks provide competencies and skill sets for decision making in seven areas:

1. The Accounting Track is designed to offer additional courses for students having prior academic preparation in accounting to enable them to satisfy the educational requirements for Certified Public Accountant (CPA) licensure in Pennsylvania and most other states;
2. the Business Analytics Track is intended to enhance data analytical skills enabling managers to synthesize data to make strategic decisions;
3. the Finance Track provides advanced corporate finance and investment knowledge enabling managers to apply various financial tools in decision making;
4. the Information Systems Track is designed to provide competencies enabling managers to develop and implement information technology;
5. the Strategic Leadership and Innovation Track is intended to further sharpen leadership and management skills;
6. the Supply Chain Management Track provides competencies needed to develop improvement and innovation in organizational supply chains; and
7. the General Business Track is provided for students who wish to develop a broad generalist program, or who have a particular personal or professional goals not met by one of the other tracks.

The list of courses required for each track and additional approved elective courses is maintained by the graduate program office.

Transfer Credits

Penn State allows a maximum of 10 transfer credits of high-quality work to be applied toward the requirements for a graduate degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>).

Course Substitutions

Some students enter the program with advanced course work in one or more subject areas (e.g., a degree in accounting plus a C.P.A.) making some prescribed course work redundant. Except for BUS 588 which must be taken at Penn State Harrisburg, students may petition or be advised by the program to replace up to 6 credits in Prescribed Courses with an equivalent number of credits of more advanced graduate courses in the same subject area. Courses must have been completed within five years prior to the date of first degree registration at the Graduate School of Penn State, must be of at least B quality (grades of B- are not transferable), and must appear on an official transcript of a regionally accredited U.S. institution or recognized degree-granting international institution.

Integrated Undergrad-Grad Programs

Integrated B.S. in Accounting And M.B.A. in Business Administration

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The School of Business Administration offers a limited number of academically superior Bachelor of Science in Accounting candidates the opportunity to enroll in an integrated, continuous program of study leading to both the Bachelor of Science in Accounting and the Master of Business Administration. The ability to coordinate as well as concurrently pursue the two degree programs enables the students to earn both degrees in five years. Specifically, as many as twelve of the credits required for the master's degree may be applied to both undergraduate and graduate degree programs.

If for any reason students admitted to the IUG program are unable to complete the requirements for the Master of Business Administration degree, the students will be permitted to receive the Bachelor of Science in Accounting degree assuming all the undergraduate degree requirements have been satisfactorily completed.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students apply to the program via the Graduate School application for admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet the admission requirements of the Graduate School, as well as the admission requirements for the M.B.A., listed on the Admission Requirements tab. Students should mention in the notes section that the application is for the IUG program in Business Administration. Students must submit:

- a resume,
- a personal statement including career goals and how the M.B.A. will enhance their career goals,
- official transcripts of all post-secondary courses (<http://gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>) taken outside Penn State,

- two letters of recommendation, with at least one from the School of Business Administration faculty,
- and a plan of study that integrates both undergraduate and graduate requirements.

The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program. A graduate faculty adviser in collaboration with the Director of M.B.A. Program will help undergraduate candidates determine a sequence of courses that will prepare them for acceptance into the Integrated Undergraduate-Graduate (IUG) degree program.

The Graduate Management Admission Test (GMAT) or Graduate Record Examination (GRE) is not required for admission into the program; however, if students are interested in a graduate assistantship, GMAT or GRE scores must be submitted by the end of the eighth semester.

The number of openings in the IUG program is limited. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. In addition, the applicants must earn a minimum of cumulative grade point average of 3.5 and complete the following Entry to Major courses or equivalent:

Code	Title	Credits
ACCTG 211	Financial and Managerial Accounting for Decision Making	4
ECON 102	Introductory Microeconomic Analysis and Policy	3
ENGL 15	Rhetoric and Composition	3
or ENGL 30H	Honors Rhetoric and Composition	
FIN 301	Corporation Finance	3
MATH 110	Techniques of Calculus I	4
or MATH 140	Calculus With Analytic Geometry I	
MGMT 301	Basic Management Concepts	3
MKTG 301	Principles of Marketing	3
STAT 200	Elementary Statistics	4
or SCM 200	Introduction to Statistics for Business	

Student applications will be evaluated based on their overall portfolio, in addition to the above requirements. In all cases, admission to the program will be at the discretion of the Graduate Admissions Committee in Business Administration.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.S. in Accounting are listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.B.A. degree are listed on the Degree Requirements tab. Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees. All courses counted for both degrees must be at the 500- or 800-level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely

towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
ACCT 504	Auditing Theory and Practice	3
ACCT 510	Business Tax Planning Theory and Practice	3
ACCT 532	Accounting Information and Decision Systems	3
ACCT 545	Strategic Cost Management	3
ACCT 561	Financial Statement Analysis II	3
ACCT 572	Financial Reporting I	3
ACCT 573	Financial Reporting II	3
FINAN 521	Corporate Finance	3

Integrated B.S. in Finance and M.B.A. IN BUSINESS ADMINISTRATION

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The School of Business Administration offers a limited number of academically superior Bachelor of Science in Finance candidates the opportunity to enroll in an integrated, continuous program of study leading to both the Bachelor of Science in Finance and the Master of Business Administration. The ability to coordinate as well as concurrently pursue the two degree programs enables the students to earn both degrees in five years. Specifically, as many as twelve of the credits required for the master's degree may be applied to both undergraduate and graduate degree programs.

If for any reason students admitted to the IUG program are unable to complete the requirements for the Master of Business Administration degree, the students will be permitted to receive the Bachelor of Science in Finance degree assuming all the undergraduate degree requirements have been satisfactorily completed.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students apply to the program via the Graduate School application for admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet the admission requirements of the Graduate School, as well as the admission requirements for the M.B.A., listed on the Admission Requirements tab. Students should mention in the notes section that the application is for the IUG program in Business Administration. Students must submit:

- a resume,
- a personal statement including career goals and how the M.B.A. will enhance their career goals,

- official transcripts of all post-secondary courses (<http://gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>) taken outside Penn State,
- two letters of recommendation, with at least one from the School of Business Administration faculty,
- and a plan of study that integrates both undergraduate and graduate requirements.

The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program. A graduate faculty adviser in collaboration with the Director of M.B.A. Program will help undergraduate candidates determine a sequence of courses that will prepare them for acceptance into the Integrated Undergraduate-Graduate (IUG) degree program.

The Graduate Management Admission Test (GMAT) or Graduate Record Examination (GRE) is not required for admission into the program; however, if students are interested in a graduate assistantship, GMAT or GRE scores must be submitted by the end of the eighth semester.

The number of openings in the IUG program is limited. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. In addition, the applicants must earn a minimum of cumulative grade point average of 3.5 and complete the following Entry to Major courses or equivalent:

Code	Title	Credits
ACCTG 211	Financial and Managerial Accounting for Decision Making	4
ECON 102	Introductory Microeconomic Analysis and Policy	3
ENGL 15	Rhetoric and Composition	3
or ENGL 30H	Honors Rhetoric and Composition	
FIN 301	Corporation Finance	3
MATH 110	Techniques of Calculus I	4
or MATH 140	Calculus With Analytic Geometry I	
MGMT 301	Basic Management Concepts	3
MKTG 301	Principles of Marketing	3
STAT 200	Elementary Statistics	4
or SCM 200	Introduction to Statistics for Business	

Student applications will be evaluated based on their overall portfolio, in addition to the above requirements. In all cases, admission to the program will be at the discretion of the Graduate Admissions Committee in Business Administration.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.S. in Finance are listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.B.A. degree are listed on the Degree Requirements tab. Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees. All courses counted for both degrees must be at the 500- or 800-level.

Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
ACCT 540	Accounting for Managerial Decisions	3
FINAN 518	Financial Markets and the Economy	3
FINAN 522	Investment and Portfolio Management	3
FINAN 523	Risk Management of Modern Financial Institutions	3
FINAN 526	International Finance	3
FINAN 527	Derivative Securities	3
FINAN 530	Corporate Finance II	3
FINAN 531	Managing Financial Operations	3
INFSY 540	Information Technology and Knowledge Management	3

Integrated B.S. in Information Systems and M.B.A. IN BUSINESS ADMINISTRATION

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The School of Business Administration offers a limited number of academically superior Bachelor of Science in Information Systems candidates the opportunity to enroll in an integrated, continuous program of study leading to both the Bachelor of Science in Information Systems and the Master of Business Administration. The ability to coordinate as well as concurrently pursue the two degree programs enables the students to earn both degrees in five years. Specifically, as many as twelve of the credits required for the master's degree may be applied to both undergraduate and graduate degree programs.

If for any reason students admitted to the IUG program are unable to complete the requirements for the Master of Business Administration degree, the students will be permitted to receive the Bachelor of Science in Information Systems degree assuming all the undergraduate degree requirements have been satisfactorily completed.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students apply to the program via the Graduate School application for admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet the admission requirements of the Graduate School, as well as the admission requirements for the M.B.A., listed on the Admission Requirements tab. Students should mention in the

notes section that the application is for the IUG program in Business Administration. Students must submit:

- a resume,
- a personal statement including career goals and how the M.B.A. will enhance their career goals,
- official transcripts of all post-secondary courses (<http://gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>) taken outside Penn State,
- two letters of recommendation, with at least one from the School of Business Administration faculty,
- and a plan of study that integrates both undergraduate and graduate requirements.

The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program. A graduate faculty adviser in collaboration with the Director of M.B.A. Program will help undergraduate candidates determine a sequence of courses that will prepare them for acceptance into the Integrated Undergraduate-Graduate (IUG) degree program.

The Graduate Management Admission Test (GMAT) or Graduate Record Examination (GRE) is not required for admission into the program; however, if students are interested in a graduate assistantship, GMAT or GRE scores must be submitted by the end of the eighth semester.

The number of openings in the IUG program is limited. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. In addition, the applicants must earn a minimum of cumulative grade point average of 3.5 and complete the following Entry to Major courses or equivalent:

Code	Title	Credits
ACCTG 211	Financial and Managerial Accounting for Decision Making	4
ECON 102	Introductory Microeconomic Analysis and Policy	3
ENGL 15 or ENGL 30H	Rhetoric and Composition Honors Rhetoric and Composition	3
FIN 301	Corporation Finance	3
MATH 110 or MATH 140	Techniques of Calculus I Calculus With Analytic Geometry I	4
MGMT 301	Basic Management Concepts	3
MKTG 301	Principles of Marketing	3
STAT 200 or SCM 200	Elementary Statistics Introduction to Statistics for Business	4

Student applications will be evaluated based on their overall portfolio, in addition to the above requirements. In all cases, admission to the program will be at the discretion of the Graduate Admissions Committee in Business Administration.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.S. in Information Systems are listed

in the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.B.A. degree are listed on the Degree Requirements tab. Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees. All courses counted for both degrees must be at the 500- or 800-level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
FINAN 521	Corporate Finance	3
INFSY 540	Information Technology and Knowledge Management	3
INFSY 547	WEB Enabled Technologies	3
INFSY 555	Data Management Systems	3
INFSY 565	Intelligent Systems in Business	3
INFSY 566	Data Mining and Knowledge Discovery	3
INFSY 570	Software Engineering in the Analysis and Design of Information Systems	3
INFSY 860	Data Communications Systems and Networks	3

Integrated B.S. in Management and M.B.A. IN BUSINESS ADMINISTRATION

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The School of Business Administration offers a limited number of academically superior Bachelor of Science in Management candidates the opportunity to enroll in an integrated, continuous program of study leading to both the Bachelor of Science in Management and the Master of Business Administration. The ability to coordinate as well as concurrently pursue the two degree programs enables the students to earn both degrees in five years. Specifically, as many as twelve of the credits required for the master's degree may be applied to both undergraduate and graduate degree programs.

If for any reason students admitted to the IUG program are unable to complete the requirements for the Master of Business Administration degree, the students will be permitted to receive the Bachelor of Science in Management degree assuming all the undergraduate degree requirements have been satisfactorily completed.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students apply to the program via the Graduate School application for admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet the admission requirements of the Graduate School, as well as the admission requirements for the M.B.A., listed on the Admission Requirements tab. Students should mention in the notes section that the application is for the IUG program in Business Administration. Students must submit:

- a resume,
- a personal statement including career goals and how the M.B.A. will enhance their career goals,
- official transcripts of all post-secondary courses (<http://gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>) taken outside Penn State,
- two letters of recommendation, with at least one from the School of Business Administration faculty,
- and a plan of study that integrates both undergraduate and graduate requirements.

The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program. A graduate faculty adviser in collaboration with the Director of M.B.A. Program will help undergraduate candidates determine a sequence of courses that will prepare them for acceptance into the Integrated Undergraduate-Graduate (IUG) degree program.

The Graduate Management Admission Test (GMAT) or Graduate Record Examination (GRE) is not required for admission into the program, unless students have not completed 24 or more credits at Penn State, in which case they must take the GMAT and earn a score of at least 450. If students are interested in a graduate assistantship, GMAT or GRE scores must be submitted by the end of the eighth semester.

The number of openings in the IUG program is limited. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. In addition, the applicants must earn a minimum of cumulative grade point average of 3.5 and complete the following Entry to Major courses or equivalent:

Code	Title	Credits
ACCTG 211	Financial and Managerial Accounting for Decision Making	4
ECON 102	Introductory Microeconomic Analysis and Policy	3
ENGL 15	Rhetoric and Composition	3
or ENGL 30H	Honors Rhetoric and Composition	
FIN 301	Corporation Finance	3
MATH 110	Techniques of Calculus I	4
or MATH 140	Calculus With Analytic Geometry I	
MGMT 301	Basic Management Concepts	3
MKTG 301	Principles of Marketing	3
STAT 200	Elementary Statistics	4
or SCM 200	Introduction to Statistics for Business	

Student applications will be evaluated based on their overall portfolio, in addition to the above requirements. In all cases, admission to the program will be at the discretion of the Graduate Admissions Committee in Business Administration.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.S. in Management are listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.B.A. degree are listed on the Degree Requirements tab. Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees. All courses counted for both degrees must be at the 500- or 800-level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
INFSY 540	Information Technology and Knowledge Management	3
MNGMT 505	Managing Human Resources	3
MNGMT 514	Organizational Innovation and New Venture Development	3
MNGMT 515	Labor Management Relations	3
MNGMT 520	Organizational Transformation	3
MNGMT 570	Leadership Development	3
MRKT 514	Strategic Mrkt	3

Integrated B.S. in Marketing and M.B.A. IN BUSINESS ADMINISTRATION

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The School of Business Administration offers a limited number of academically superior Bachelor of Science in Marketing candidates the opportunity to enroll in an integrated, continuous program of study leading to both the Bachelor of Science in Marketing and the Master of Business Administration. The ability to coordinate as well as concurrently pursue the two degree programs enables the students to earn both degrees in five years. Specifically, as many as twelve of the credits required for the master's degree may be applied to both undergraduate and graduate degree programs.

If for any reason students admitted to the IUG program are unable to complete the requirements for the Master of Business Administration degree, the students will be permitted to receive the Bachelor of Science

in Marketing degree assuming all the undergraduate degree requirements have been satisfactorily completed.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students apply to the program via the Graduate School application for admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet the admission requirements of the Graduate School, as well as the admission requirements for the M.B.A., listed on the Admission Requirement tab. Students should mention in the notes section that the application is for the IUG program in Business Administration. Students must submit:

- a resume,
- a personal statement including career goals and how the M.B.A. will enhance their career goals,
- official transcripts of all post-secondary courses (<http://gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>) taken outside Penn State,
- two letters of recommendation, with at least one from the School of Business Administration faculty,
- and a plan of study that integrates both undergraduate and graduate requirements.

The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program. A graduate faculty adviser in collaboration with the Director of M.B.A. Program will help undergraduate candidates determine a sequence of courses that will prepare them for acceptance into the Integrated Undergraduate-Graduate (IUG) degree program.

The Graduate Management Admission Test (GMAT) or Graduate Record Examination (GRE) is not required for admission into the program; however, if students are interested in a graduate assistantship, GMAT or GRE scores must be submitted by the end of the eighth semester.

The number of openings in the IUG program is limited. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. In addition, the applicants must earn a minimum of cumulative grade point average of 3.5 and complete the following Entry to Major courses or equivalent:

Code	Title	Credits
ACCTG 211	Financial and Managerial Accounting for Decision Making	4
ECON 102	Introductory Microeconomic Analysis and Policy	3
ENGL 15	Rhetoric and Composition	3
or ENGL 30H	Honors Rhetoric and Composition	
FIN 301	Corporation Finance	3
MATH 110	Techniques of Calculus I	4

or MATH 140	Calculus With Analytic Geometry I	
MGMT 301	Basic Management Concepts	3
MKTG 301	Principles of Marketing	3
STAT 200	Elementary Statistics	4
or SCM 200	Introduction to Statistics for Business	

Student applications will be evaluated based on their overall portfolio, in addition to the above requirements. In all cases, admission to the program will be at the discretion of the Graduate Admissions Committee in Business Administration.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.S. in Marketing are listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.B.A. degree are listed on the Degree Requirements tab. Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees. All courses counted for both degrees must be at the 500- or 800-level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
BUS 515	Business Ethics and Corporate Governance	3
INFSY 540	Information Technology and Knowledge Management	3
MRKT 514	Strategic Mrkt	3
MRKT 571	Consumer Behavior	3
MRKT 572	Marketing Research	3
MRKT 585	Business-to-Business Marketing	3
MRKT 587	Global Marketing	3

Integrated B.S. in Project and Supply Chain Management and M.B.A. IN BUSINESS ADMINISTRATION

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The School of Business Administration offers a limited number of academically superior Bachelor of Science in Project and Supply Chain Management candidates the opportunity to enroll in an integrated, continuous program of study leading to both the Bachelor of Science in Project and Supply Chain Management and the Master of Business Administration. The ability to coordinate as well as concurrently pursue the two degree programs enables the students to earn both degrees in five years. Specifically, as many as twelve of the credits required for the

master's degree may be applied to both undergraduate and graduate degree programs.

If for any reason students admitted to the IUG program are unable to complete the requirements for the Master of Business Administration degree, the students will be permitted to receive the Bachelor of Science in Project and Supply Chain Management degree assuming all the undergraduate degree requirements have been satisfactorily completed.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students apply to the program via the Graduate School application for admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet the admission requirements of the Graduate School, as well as the admission requirements for the M.B.A., listed on the Admission Requirements tab. Students should mention in the notes section that the application is for the IUG program in Business Administration. Students must submit:

- a resume,
- a personal statement including career goals and how the M.B.A. will enhance their career goals,
- official transcripts of all post-secondary courses (<http://gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>) taken outside Penn State,
- two letters of recommendation, with at least one from the School of Business Administration faculty,
- and a plan of study that integrates both undergraduate and graduate requirements.

The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program. A graduate faculty adviser in collaboration with the Director of M.B.A. Program will help undergraduate candidates determine a sequence of courses that will prepare them for acceptance into the Integrated Undergraduate-Graduate (IUG) degree program.

The Graduate Management Admission Test (GMAT) or Graduate Record Examination (GRE) is not required for admission into the program; however, if students are interested in a graduate assistantship, GMAT or GRE scores must be submitted by the end of the eighth semester.

The number of openings in the IUG program is limited. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. In addition, the applicants must earn a minimum of cumulative grade point average of 3.5 and complete the following Entry to Major courses or equivalent:

Code	Title	Credits
ACCTG 211	Financial and Managerial Accounting for Decision Making	4
ECON 102	Introductory Microeconomic Analysis and Policy	3

ENGL 15	Rhetoric and Composition	3
or ENGL 30H	Honors Rhetoric and Composition	
FIN 301	Corporation Finance	3
MATH 110	Techniques of Calculus I	4
or MATH 140	Calculus With Analytic Geometry I	
MGMT 301	Basic Management Concepts	3
MKTG 301	Principles of Marketing	3
STAT 200	Elementary Statistics	4
or SCM 200	Introduction to Statistics for Business	

Student applications will be evaluated based on their overall portfolio, in addition to the above requirements. In all cases, admission to the program will be at the discretion of the Graduate Admissions Committee in Business Administration.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.S. in Project and Supply Chain Management are listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.B.A. degree are listed on the Degree Requirements tab. Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees. All courses counted for both degrees must be at the 500- or 800-level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
ACCT 540	Accounting for Managerial Decisions	3
FINAN 530	Corporate Finance II	3
INFSY 540	Information Technology and Knowledge Management	3
SCIS 525	Supply Chain Optimization	3
SCIS 540	Transportation and Distribution Management	3
SCIS 546	Procurement and Supply Management	3
SCIS 565	Supply Chain Strategy	3
SCIS 570	Supply Chain Engineering	3

Joint Degrees

Joint J.D./M.B.A. with Dickinson Law

Requirements listed here are in addition to requirements listed in GCAC-211 Joint Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-211-joint-degree-programs/>).

Dickinson Law and the School of Business Administration at Penn State Harrisburg offer cooperative programs leading to the degrees of Juris Doctor (J.D.) granted by Dickinson Law and the Master of Business Administration (M.B.A.) granted by Penn State Harrisburg, The Capital

College. This joint degree opportunity facilitates the completion of both a law degree and a professional master's degree in business administration.

Admission Requirements

Applicants to the joint degree program must apply and be admitted first to Dickinson Law. Subsequently, the student is recommended for and applies for admission to the Graduate School for the Master of Business Administration graduate program. Admissions requirements and applications for admission for Dickinson Law are listed in the J.D. Admissions (<https://dickinsonlaw.psu.edu/admissions-aid/>) section of the Dickinson Law website.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the J.D. program are listed on the Dickinson Law website (<https://dickinsonlaw.psu.edu/academics/curriculum/jd-program/>). Degree requirements for the M.B.A. degree are listed in the Degree Requirements section. Nine credits of course work at Dickinson Law may be double-counted toward the M.B.A. degree, subject to program approval. Students must obtain a grade satisfactory to the M.B.A. program in order for the credits to be double-counted for credit toward the J.D. degree at the Dickinson Law subject to the approval of Dickinson Law.

Advising of Students

All students in the joint degree program have two advisers, one in the School of Business Administration and one from the faculty at Dickinson Law. Because the joint degree program is designed to be taken in synchrony with the objective that both degrees will be earned simultaneously, students who do not demonstrate progress toward completion of both degrees may be denied continuation in the joint degree program. Such a decision will rest jointly with the faculties of the M.B.A. program and the J.D. program. Students can graduate with one degree before the other as long as they have completed all of the requirements for the degree. If students accepted into the joint degree program are unable to complete the J.D. degree, they are still eligible to receive the M.B.A. degree if all the M.B.A. degree requirements have been satisfied.

Tuition

Penn State Dickinson Law and Penn State Harrisburg will each charge their own tuition to students in the joint degree program.

Additional Information

For more information and the latest updates on the joint degree program, contact Dickinson Law (<https://dickinsonlaw.psu.edu/>) or the M.B.A. program at Penn State Harrisburg (<https://harrisburg.psu.edu/business-administration/mba-and-business-administration/master-business-administration/>).

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Full-time graduate students who are interested in an assistantship should contact the program director. Students must be nominated for an assistantship by their program director. Students applying for an assistantship should submit scores from the Graduate Management Admissions test, or similar examinations by the deadline.

A limited number of scholarships, fellowships, and research grants are available, as well as several graduate assistantships. For more information on these, contact the School of Business Administration.

Many students work full-time and take classes part-time. In many cases, employers have a tuition-reimbursement plan paying for partial or full tuition. To find other options available to you, contact the Office of Student Aid (<https://harrisburg.psu.edu/financial-aid/>), 717-948-6307.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Business (BUS) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/bus/>)

Contact

Campus	Harrisburg
Graduate Program Head	John Haddad
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Mohammad A Ali
Program Contact	Amy J Atkins Graduate Admissions 777 West Harrisburg Pike Middletown PA 17057 akj11@psu.edu (717) 948-6142
Program Website	View (https://harrisburg.psu.edu/business-administration/mba-and-business-administration/master-business-administration/)

Business Administration (Executive)

Graduate Program Head	Brian Cameron
Program Code	EXMBA
Campus(es)	University Park (M.B.A.)
Degrees Conferred	Master of Business Administration (M.B.A.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=EXMBA)

The Smeal Executive MBA program provides a concentration in Executive Leadership and Strategy and can be completed in as little as 17 months. For the first 13 months, students meet on alternating Friday afternoons and Saturdays at The Union League Liberty Hall Conference Center in Lafayette Hill, PA, complemented with two residency weeks on the University Park campus. After the 13 month residency component, students select 6 to 12 credits of online courses to complete their degree and earn an additional concentration. In addition, every graduate has the option to complete one of Penn State Smeal's online graduate certificates. This allows all students to receive the Executive Leadership and Strategy concentration through the EMBA curriculum while allowing each individual to choose an area of specialization. Students must formally apply and be admitted into the certificate program, and online graduate certificates must be completed within three years of graduation.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Criteria for evaluating applicants include professional and academic accomplishments, and personal data from application forms that provide indications of future academic and professional accomplishment. Applications for the Executive M.B.A. degree are only accepted for Fall semester admission.

Degree Requirements

Master of Business Administration (M.B.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The EMBA program consists of two distinct portions:

1. preprogram competency expectations, including accounting, mathematics, and statistics; and
2. a minimum of 40 credits at the 400, 500, or 800 levels, and a minimum of 18 credits at the 500 or 800 level, with at least 6 credits at the 500 level.

Of the minimum 40 credits, 28 credits are required core courses:

Code	Title	Credits
Required Core Courses		
BA 512	Quantitative Analysis for Managerial Decision Making	2
BA 533	Economics for Managers	2
BA 800	Marketing Management	2
BA 801	Management	2
BA 802	Team Process and Performance	1
BA 804	Ethical Leadership	2
BA 805	Negotiation Theory and Skills	1
BA 810	Supply Chain and Operations Management	2
BA 811	Financial Accounting	2
BA 815	Business Statistics for Contemporary Decision Making	2
BA 817	Communication Skills for Management	2
BA 821	Foundation in Managerial Accounting	2
BA 831	Foundations in Finance	2
BA 832	Global Business Environment	1
BA 835	Global Perspectives	1
Concentration Electives		
Select 12-18 Concentration credits ¹		12-18
Culminating Experience		
BA 571	Strategic Management (Capstone Course) ²	2
Total Credits		40-46

¹ The 12-18 elective credits must be chosen from a list of approved concentration elective courses maintained by the graduate program office. The number of required credits will depend on selection of concentrations.

² The culminating experience for the M.B.A. is the capstone course BA 571. This course is designed to bring together the many functional areas previously studied and integrate them into a strategic analysis of the firm.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/>).

graduate-education-policies/), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Refer to the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students in this program are not eligible for graduate assistantships.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Business Administration (BA) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/ba/>)

Learning Outcomes

1. Communication Skills—Argue your point persuasively whether in written, oral, or presentation form.
2. Global Perspective—Anticipate, understand, and explain the global forces that influence business decisions.
3. Professional Skills—Be both a principled leader and a valuable member of a team.
4. Problem Solving Skills—Analyze a complicated business problem using the best tools, theories, and evidence, complemented by the ability to recommend solutions and implementation plans.
5. Integrative Understanding—Consider many perspectives in analyzing and recommending solutions to business problems.

Contact

Campus	University Park
Graduate Program Head	Brian Harold Cameron
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Louis Gattis
Program Contact	Tara T Banerjee 220B Business Building University Park PA 16802 ttb3@psu.edu (814) 863-0476
Program Website	View (https://emba.smeal.psu.edu/)

Business Administration (Great Valley)

Graduate Program Head	Zugang Liu
Program Code	BUSAD
Campus(es)	Great Valley (M.B.A.)
Degrees Conferred	Master of Business Administration (M.B.A.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=BUSAD)

The Master of Business Administration (M.B.A.) program at Penn State Great Valley prepares tomorrow's leaders in strategic thinking, problem solving, effective communication, innovation, and ethical leadership. The program is fully accredited by AACSB International.

In addition to the campus in Malvern, the M.B.A. program is also offered at Penn State Abington, Penn State Berks, and Penn State at the Navy Yard in Philadelphia.

Course work integrates key areas of business, including finance, accounting, marketing, information systems, organizational behavior, leadership, international business, and human resources. The program also offers concentrations in finance, human resource management, and sustainability management. Courses are offered in a flexible, online-hybrid optional format designed for working adults seeking a degree without career interruption. Premier faculty combine their research with business enterprise expertise to give students a valuable and innovative classroom experience. Our applications-oriented program explores real-world issues through case studies, projects, simulations, and guest lecturers who are leaders in business and industry.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Applicants are evaluated on their portfolio of academic performance, relevant work experience, quantitative and analytical skills as evidenced from coursework and/or work experience. Scores from the Graduate Management Admission Test (GMAT) may be waived

based on a combination of factors such as experience, performance in undergraduate coursework, or advanced degree.

Admission decisions are based on the quality of the applicant's credentials in relation to those of other applicants. Evaluation criteria include:

- professional and academic accomplishments
- one letter of recommendation
- a personal statement that provides indications of future academic and professional potential
- GMAT scores (if applicable).

Application filing dates: Penn State Great Valley's M.B.A. program has a rolling admission policy. New students may start classes in fall, spring, or summer sessions.

Degree Requirements

Master of Business Administration (M.B.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Completion of the M.B.A. degree will require 30-48 credits of course work at the 400, 500, and 800 level, with at least 6 credits at the 500 level. This includes 9 credits of Required Courses, 18 credits of Foundations Courses, 15 Credits of Essential Courses, and 6 credits of Elective Courses. Students may have up to 18 credits of the required Foundations Courses waived in accordance with the course exemption guidelines for the M.B.A. program, in which case the total credits required for the degree may be reduced in an equivalent manner, down to the base minimum of 30 credits. To be eligible for exemption from a single foundation course, students must have completed at least two equivalent undergraduate courses with a grade of B or higher, no more than seven years prior to admission to the M.B.A. program. At the admission committee's discretion, a competency exam may be required to receive certain course exemptions. Time limits may be waived by the M.B.A. program on the basis of post-graduate training or current and relevant work experience. If a waiver is not granted, students must complete all Foundation Courses prior to starting advanced course work.

Code	Title	Credits
Required Courses ¹		
MGMT 501	Behavioral Science in Business	3
MGMT 507	Positive Organizational Behavior and Wellbeing	3
MGMT 871	Strategic Management (Capstone Course)	3
Foundations Courses ²		
BUSAD 801	Statistical Analysis for Managerial Decision Making	3
ACCTG 800	Financial and Managerial Accounting	3
MBADM 820	Financial Management	3
BUSAD 523	Prices and Markets	3
BA 800	Marketing Management	3
BA 810	Supply Chain and Operations Management	3
Essential Courses ³		

One course in each of the following categories: Leadership and Interpersonal Dynamics, Ethical Dimensions of Business, Analyzing and Managing Global Systems, Managing Innovation and Entrepreneurship, and Managing Technology Agility. A list of courses that will satisfy these requirements is maintained by the program office.

Electives ⁴	6
Total Credits	48

¹ Required courses provide an overview of the management discipline at the beginning of the program. The capstone course (MGMT 871) is a culminating experience that provides students with an opportunity to strategically integrate and apply what they have learned in their course work.

² Foundations courses provide an overview of key business processes and functional areas of organizations. One or more foundations courses can be waived based on previous undergraduate coursework.

³ Essential Courses build necessary competencies for effective managerial practice, knowledge of key elements of contemporary business, and ethical decision-making. Electives provide an opportunity for students to pursue their interests.

⁴ Electives provide an opportunity for students to pursue their interests and develop distinctive competencies by pursuing advanced courses offered or approved by the Management Division. A list of approved elective courses is maintained by the graduate program office.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Refer to the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students in this program are not eligible for graduate assistantships.

Financial aid for students in on-campus programs is in the form of student loans and a limited number of small scholarships, as described on the Penn State Great Valley website (<https://greatvalley.psu.edu/tuition-and-financial-aid/>).

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

Upon completion of the MBA program, our graduates will:

- Learning Goal 1: Integrate theory, research, and practice from all functional areas – accounting, economics, finance, marketing, operations research, management, and organization – to solve business problems within dynamic environments.
 - Demonstrate ability to integrate the various business functions to good effect.
 - Demonstrate appreciation of the role of contexts when developing and executing strategy.
- Learning Goal 2: Critically evaluate and make ethical decisions with consideration for multiple stakeholders.
 - Evaluate and analyze the ethical dimension of decision-making.
- Learning Goal 3: Demonstrate communication behaviors that reflect an awareness of context, relationships, others' perspectives, and individual as well as organizational goals.
 - Communicate their intended message clearly and professionally to individuals, teams, and external stakeholders.
 - Demonstrate an ability to engage in perspective taking and conflict management
 - Demonstrate an ability to adapt communication behaviors to dynamic, multicultural, and/or complex contexts.
- Learning Goal 4: Demonstrate an appreciation of technology as a strategic tool.
 - Identify and evaluate the functional, financial, operational, and social impact of technology.
- Learning Goal 5: Demonstrate knowledge of business in multicultural contexts and the opportunities and challenges of globalization.
 - Demonstrate an understanding of the impact of global markets and finance on business decisions.

Contact

Campus	Great Valley
Graduate Program Head	Zugang Liu
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Sagnika Sen
Program Contact	DENISE Y. SMITH Penn State Great Valley 30 E. Swedesford Road Malvern PA 19355 dms7338@psu.edu (610) 648-3336
Program Website	View (http://greatvalley.psu.edu/academics/masters-degrees/business-administration/)

Business Administration (Intercollege)

Graduate Program Head	Brian Cameron
Program Code	MBADM
Campus(es)	World Campus (M.B.A.)
Degrees Conferred	Master of Business Administration (M.B.A.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=MBADM)

The Penn State Online Master of Business Administration, led by the Smeal College of Business, is an online degree program of:

- Penn State Erie, The Behrend College;
- Penn State Great Valley, The School of Graduate Professional Studies;
- Penn State Harrisburg, the Capital College;
- and Penn State University Park, the Smeal College of Business.

The online M.B.A. curriculum emphasizes cross-functional organizational thinking; focuses on solving business problems; closely follows the quality guidelines for accreditation of AACSB (Association to Advance Collegiate Schools of Business), the accrediting body affiliated with The International Association for Management Education; and uses cutting-edge instructional technology to transcend issues of time and space to support effective teaching and learning.

Within the context of these goals, the online M.B.A. curriculum was developed around core business skills. The skills the program helps to develop include "soft skills" such as managing and leading people and teams, analytical skills such as data analytic decision making, and integrative skills that allow students to understand, analyze, and suggest solutions to significant business problems that cross functional areas of business.

These different skills are integrated at the course level. Students apply knowledge developed in these areas to multidimensional problems and issues throughout the program. The program is offered online and includes a required three-day virtual residency experience at the start of the program.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Admission is granted only to candidates who demonstrate high promise of success for graduate work. Admissions decisions are based on a review of a complete admission portfolio, including an application, short essays, a current resume, official transcripts from all post-secondary institutions attended (<http://gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>), and two letters of recommendation. Graduate Management Admission Test (GMAT) or Graduate Record Exam (GRE) scores will not be accepted.

No specific prior course of study is required to be admitted. Applicants come from a wide range of backgrounds. Students entering the program are required to have a working knowledge of the Microsoft Office suite.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Exceptions to GCAC-305 (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) will be considered by the program. Exceptions may or may not be granted by the Graduate School.

Degree Requirements

Master of Business Administration (M.B.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The online M.B.A. degree requires a minimum of 48 credits.

Code	Title	Credits
Required Courses		
MBADM 810	Team Performance	3
MBADM 811	Financial Accounting ¹	3
MBADM 812	Economics for Business Strategy ¹	3
MBADM 813	Data Analysis for Decision Making ¹	3
MBADM 814	Leadership Communications and Change Management	3
MBADM 815	Ethical and Responsible Business Leadership	3
MBADM 816	Managing and Leading People in Organizations	3
MBADM 820	Financial Management	3
MBADM 821	Marketing in a Global Environment	3
MBADM 822	Managing Supply Chains in Global Markets	3
MBADM 850	Corporate Innovation and Entrepreneurship	3
MBADM 830	Managing in the Digital Economy	3
Electives		
Select 9 elective credits		9
Culminating Experience		
MBADM 571	Global Strategic Management ²	3
Total Credits		48

¹ For students with exceptional credentials, MBADM 811, MBADM 812, and MBADM 813 may be waived. Students must petition the head of the graduate program to obtain a waiver for these courses, and students' credentials will be reviewed to assess their eligibility for a waiver. Obtaining a waiver for MBADM 811, MBADM 812, and MBADM 813 will not reduce the minimum 48 credits required for the degree. Alternate courses may be substituted for the courses waived.

² The culminating experience for the Online MBA is MBADM 571. As the course title implies, MBADM 571 gives students a view of the whole firm and helps them understand how finance, marketing, and operations collectively support the strategy and mission of the firm. Students in this course will typically analyze their own firm to give them

a comprehensive understanding of how the firm intends to achieve its goals.

Due to the engaging experience of the OMBA Team Performance Immersion, attendance is mandatory. This is the only time during the program students will be required to be on Zoom synchronously and during weekday working hours. To provide the best learning experience, students will be involved in individual and team activities during the 3-day immersion.

Students must participate actively in the 3-day Immersion experience; no alternatives are permitted.

Other Relevant Information

The online MBA is an online graduate degree program delivered via World Campus (<http://www.worldcampus.psu.edu/>). Students must be computer literate and have immediate, ready, and reliable access to a computer and the Internet. Although not all aspects of the course are delivered via electronic media, Internet access is required to successfully complete the course of instruction, as well as participate in online discussion groups. See World Campus Technical Requirements (<http://www.worldcampus.psu.edu/general-technical-requirements/>) for the most current technical requirements.

Students are required to complete the 3-day residency experience. No alternatives and substitutions are possible.

Students may spread out their studies over a longer period of time to accommodate their professional and personal commitments, but it is strongly recommended they complete the degree in five years or less.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Master of Business Administration (MBADM) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/mbadm/>)

Learning Outcomes

1. **APPLY/CREATE:** Apply statistical techniques effectively for the purpose of critically analyzing, evaluating, preparing and presenting business decisions.
2. **COMMUNICATE:** Examine the components of effective communication (oral, written, presentation) and evaluate their impact on successful interpersonal interactions, including recognizing behavior styles that may influence communication outcomes.
3. **THINK:** Apply critical thinking skills to analyze and evaluate a problem or situation, demonstrating the ability to break it down into its constituent parts and identify potential solutions.
4. **KNOW:** Assess the effectiveness of business functions in achieving the strategic goals of a business, considering factors such as resource allocation, alignment with organizational objectives, and performance metrics.
5. **PROFESSIONAL PRACTICE:** Analyze a business problem using insights from multiple functional areas, recognizing how different perspectives and ethical standards can influence problem-solving approaches.

Contact

Campus	World Campus
Graduate Program Head	Brian Harold Cameron
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Janet Duck
Program Contact	Stacey Dorang Peeler 220 Business Building University Park PA 16802 sld138@psu.edu (814) 863-0474
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-mba-degree-program/apply/)

Business Administration (Smeal)

Graduate Program Head	Brent Ambrose (PH.D. and M.S.) Brian Cameron (D.B.A. and M.B.A.)
Program Code	BA, BUSA
Campus(es)	University Park (Ph.D., D.B.A, M.S., M.B.A.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Doctor of Business Administration (D.B.A) Master of Science (M.S.) Master of Business Administration (M.B.A.) Dual-Title Ph.D. and M.S. in Business Administration and Operations Research Integrated B.S. in Science and M.B.A. in Business Administration Joint J.D./M.B.A. with Penn State Law Joint M.D./M.B.A. with the College of Medicine
The Graduate Faculty	BUSA Graduate Faculty (Ph.D., M.S.) (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=BUSA) BA Graduate Faculty (D.B.A., M.B.A.) (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=BA)

The Master of Business Administration program is a professional degree designed to prepare individuals for managerial positions in business, government, and nonprofit institutions. The M.B.A. curriculum blends technical rigor, managerial theory, and integrative learning experiences through case studies and other teaching methods. A managerial communications course is fully integrated into the program.

The Master of Science in Business Administration program is highly flexible and designed for advanced study in a specialized field. The M.S. program is directed toward the development of competency within a defined area of management. Fields such as accounting and management science are examples of career opportunities requiring specialized knowledge and skill, including research.

The D.B.A. provides professionals and executives with advanced tools and research skills needed for strategic planning and decision making. It also prepares graduates for translating research into practice. The program empowers professionals to become experts, leaders, and pioneers. The program teaches students how to understand the individual and organizational factors that drive successful change initiatives as well as teaches groundbreaking process models of change and obstacles to improvement. Students are exposed to advanced corporate finance practices and theories regarding taxation, agency costs and market inefficiencies. Courses will help students better understand individual and organizational behaviors across different commercial contexts. Students become familiar with opportunity recognition and exploitation techniques. Marketing strategy courses cover resource planning, organizational behavior classes will scientifically interpret behaviors and classes concerning quantitative research methods will explore commercial data analysis and mathematical models. All of these courses go beyond a question of "how do I fix this", which is the defining

question of master's level classes, instead giving the students the ability to answer "why is this happening", thus giving students the tools to allow them to solve new and emergent questions arising in their organizations.

The Doctor of Philosophy degree in the Business Administration program offers advanced graduate education for students focused on research careers at leading business schools. The faculty of the college views the Ph.D. as evidencing scholarship at the highest level.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Doctor of Philosophy (Ph.D.) and Master of Science (M.S.)

Applicants to the Ph.D. program are required to take the Graduate Management Admission Test (GMAT) (<https://www.mba.com/exams/gmat/>) or the Graduate Record of Examination (GRE) (<https://www.ets.org/gre/>). The program does not admit applicants for the terminal Master of Science (M.S.) degree.

Criteria for evaluating applicants for the Ph.D. program include professional and academic accomplishments, GMAT/GRE scores, recommendations, and personal data from application forms that provide indications of future academic and professional accomplishment.

Ph.D. candidates may begin either the fall or spring semester. However, only rarely are admissions for the Ph.D. programs granted for spring semester. Individuals from all undergraduate disciplines are encouraged to apply.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Master of Business Administration (M.B.A.)

Applicants must:

- Submit a completed online Graduate School Application for Admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>), including short admissions essay, resume, and three professional references with complete contact information.
 - Résumé reflecting relevant professional experience including internships and co-op experiences.
- Submit official transcripts from all post-secondary institutions attended (<http://gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>).

GMAT and/or GRE scores will not be required for admission. Accordingly, these scores will not be accepted.

Students who do not have foundational quantitative backgrounds may be required to take MBADM 811 and/or MBADM 813 (or equivalent course work) prior to entering the program. The program faculty director will assess the background of each applicant.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Doctor of Business Administration (D.B.A.)

Criteria for evaluating D.B.A. applicants include professional and academic accomplishments, and personal data from application forms that provide indications of future academic and professional accomplishment. Applications for the DBA degree are only accepted for Fall semester admission.

The student cohort should reflect today's international business environment, with selective admittance. With this in mind, the following admission requirements are required:

- A master's degree or equivalent experience
- Approximately ten years of relevant experience
- Evidence of a foundational background in statistics and/or analytics
- Submission of the required components of the online Graduate School Application for (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) Admission, including resume.
- A 2-3 page essay describing career goals and how the D.B.A. will help achieve these goals.
- Official transcripts from all post-secondary institutions attended (<http://gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>)
- A non-refundable application fee.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

An interview will be required of all applicants which will be conducted via Zoom or other conferencing technology. Individuals without foundational statistics/analytics may be required to complete additional education prior to starting the DBA program.

Degree Requirements

Master of Business Administration (M.B.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The M.B.A. program consists of two distinct portions:

1. preprogram competency expectations, including accounting, economics, mathematics, and statistics; and
2. a minimum of 35 credits at the 500 or 800 levels, with a minimum of 18 at the 500 or 800 level and at least 6 credits at the 500 level.

Code	Title	Credits
Required Courses		
BA 512	Quantitative Analysis for Managerial Decision Making	2
BA 533	Economics for Managers	2
BA 800	Marketing Management	2
BA 801	Management	2
BA 802	Team Process and Performance	2
BA 804	Ethical Leadership	2
BA 805	Negotiation Theory and Skills	1
BA 810	Supply Chain and Operations Management	2
BA 811	Financial Accounting	2
BA 815	Business Statistics for Contemporary Decision Making	2
BA 817	Communication Skills for Management	4
BA 821	Foundation in Managerial Accounting	2
BA 830	Emerging Technology Trends in Business	1
BA 831	Foundations in Finance	2
BA 832	Global Business Environment	1
BA 835	Global Perspectives	1
BA 836	Global Immersion	1
BA 880	Leadership Immersion	2
Culminating Experience		
BA 571	Strategic Management ¹	2
Total Credits		35

¹ The culminating experience for the M.B.A. is BA 571. This course is designed to bring together the many functional areas previously studied and integrate them into a strategic analysis of the entire firm.

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Admission to the M.S. program is only available to students previously admitted to the Ph.D. program, with the approval of the Director of the Ph.D. program. The M.S. degree requires a minimum of 30 credits at the 400, 500, 600, or 800 level in business administration or related areas, including a thesis or scholarly paper. Students who complete a thesis must take at least 18 credits at the 500 or 600 level, with a minimum of 6 credits in thesis research (BA 600 or BA 610). The thesis must be accepted by the committee members, the head of the graduate program, and the Graduate School. Students who choose the non-thesis option must take at least 18 credits at the 500 level, and complete a satisfactory scholarly paper while enrolled in BA 596.

Doctor of Business Administration (D.B.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The total number of required credits for the Doctor of Business Administration program is 54 credits at the 400, 500, or 800 level, with a minimum of 24 at the 500 or 800 level. The required minimum 54 credits

include, 30 core credits, 6 elective credits, and 18 culminating research project credits.

Code	Title	Credits
Required Courses		
<i>Core Courses</i>		
MGMT 548		3
SCIS 501	Business Analytics	3
BA 511	Seminar on Statistical Analysis	3
SCIS 502	Supply Chain Strategy	3
FIN 588		3
ACCTG 502	Accounting Research and Analysis	3
BA 560		3
MKTG 556	Marketing Management	3
MGMT 591	Organizational Research Design	3
BA 559	Qualitative Analysis in Business	3
<i>Electives</i>		
	The remaining 6 elective credits must be chosen from a list of approved elective courses maintained by the graduate program office.	6
<i>Culminating Experience</i>		
BA 580	Doctorate of Business Administration Culminating Research Project	18
Total Credits		54

BA 580, in fulfillment of GCAC-707, is the Professional Doctoral Culminating Experience for the DBA program. There are several requirements and expectations associated with the culminating experience.

1. The student must engage in an original research project, wherein they collect primary (e.g., employee or customer data) or secondary (e.g., firm characteristics and performance, review of scholarly literature) data in the pursuit of answering a research question. They must analyze that data, form conclusions based upon their analyses, and produce a written product that documents the entire research project.
2. After producing the written product, the student must present their research product to their committee (noting that this is a public oral presentation). This presentation should occur at the end of the third year of study. The committee should evaluate both the written portion and the presentation on quality, documenting the originality of ideas, accuracy of research methods and analyses, and insightfulness of conclusions. Two-thirds of the committee and the faculty director of the program must vote to pass in order for the student to successfully complete this requirement.
3. The Professional Doctoral committee must meet all Graduate Council requirements

Expectations for the Culminating Research Project:

- An applied research question that may not result in creating new theory but leverages and tests existing theory to answer a research question pertinent to others in their field. This may alternately involve creating new algorithms or mathematical models to explore research questions.
- Involves the collection of data (primary or secondary), analysis of that data, and an interpretation of the results.
- The final written product should be thought of as translational work – that is, it should both be based upon and demonstrate

disciplinary knowledge but is aimed at applied practitioners. Think about targeting a version of the Culminating Research Project at Harvard Business Review, or other practitioner-oriented outlets.

Other Requirements

The qualifying examination will be completed after the first year in the program. There are several requirements and expectations associated with the qualifying exam.

1. The purpose of the qualifying exam is to provide an early assessment of whether the student has the potential to develop the knowledge, skills, and attributes included in the program.
2. The qualifying exam will be a written assessment of the student's ability to complete the Doctor of Business Administration.
3. The written product will be assessed by the Qualifying Exam Committee, which will be drawn from Graduate Faculty who are primarily faculty in the program. The committee should evaluate the written product on its quality. Two-thirds of the committee must vote to pass in order for the student to successfully complete this requirement. D.B.A. students must also pass a Comprehensive Examination. English competence shall be formally attested to by the graduate program before the doctoral student's Comprehensive Examination is scheduled.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Competency Expectations

Entrance into the doctoral program in business administration does not require the completion of an undergraduate degree specifically in business. While almost any major at the undergraduate level may be acceptable, graduate study in business administration does presume a minimum level of competency in mathematics, statistics, and computing. No transcript credit is required for entering doctoral students in these areas, except where specified by particular fields of specialization. However, it must be emphasized that lack of minimum competency in mathematics, statistics and computing could be a significant disadvantage to the student.

Breadth Requirement

All students are expected to develop a broad understanding of the functions of the business organization. To achieve breadth, all Ph.D. students must show competency by completing 12 credits at the 400, 500, or 800 level in a minimum of two of the approved fields of study within the Smeal College of Business and/or in Economics in the College of the Liberal Arts. The 12 credits in the breadth requirement must be taken in fields outside or separate from a student's primary, supporting, and research competency fields.

Primary Field Requirements

All students are required to achieve competency in a primary field of business administration. The primary field is the sphere of scholarship that commands the most extensive and intensive portion of a program and is the area in which the student's dissertation research is conducted and the Ph.D. committee chair is selected. Primary fields may be selected from the following:

- accounting;
- finance;
- insurance and real estate;

- management and organization;
- marketing;
- supply chain and information systems.

Graduate work in a selected primary field may require competency in prerequisite areas, including undergraduate work in the field itself as well as prior work in mathematics, statistics, computer science, economics, and social and behavioral sciences. The prerequisite work will be specified by each primary field.

Supporting Field Requirements

All students must select a supporting field of study from business administration or related outside areas. Those spheres of scholarship complement the student's primary field. Supporting fields from business administration include all the primary fields. Outside supporting fields include, but are not limited to,

- anthropology,
- civil engineering,
- computer science,
- economics,
- industrial engineering,
- mathematics,
- political science,
- psychology,
- sociology,
- statistics.

Research Methods Field

All students must develop a broad understanding of the scientific research process and in-depth competency in the research methods used in the primary field. Each student's Ph.D. committee shall specify a minimum of 4 courses/12 credits at the 400, 500, or 800 level (beyond the M.B.A. core courses) to constitute a supporting field in research methods. These courses should cover specific methods and tools relevant for research in the primary fields. A member of the Ph.D. committee shall be designated to represent the research methods field and shall be responsible for evaluating the student's competence in the field.

Research Paper and Presentation Requirement

To introduce students early to the research process, each Ph.D. student must complete a written research paper within two years after admission to the Ph.D. program. The student must then present the paper at an open departmental workshop or seminar within one semester after the paper is approved by the department committee and chair. The student must work under the guidance of a Research Paper Supervisor (who may or may not later be the dissertation adviser). The research paper supervisor mentors the student, possibly suggesting the research topic, monitoring progress, providing ideas and feedback, and helping the student develop appropriate research, writing, and presentation skills. The paper must substantially represent the student's work, and must be written by the student. The paper must clearly define and motivate the problem being addressed, contain a comprehensive literature review, and present the research contributions and conclusions. Approval of written paper and presentation can be used as a means to satisfy the Graduate Council English competence and communication requirement (to be completed before the comprehensive examination).

Dissertation

To earn the Ph.D. degree, doctoral candidates must write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School, and the student must pass a final oral examination (the dissertation defense).

Dual-Titles

Dual-Title M.S. and Ph.D. in Business Administration and Operations Research

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

M.S. and Ph.D. students in Smeal College of Business can elect to participate in the Operations Research dual-title graduate program. Operations Research is the use of scientific methodology in the formulation, analysis, and solution of problems of decision making.

Admissions Requirements

Students must apply and be admitted to the graduate program in Business Administration and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Operations Research dual-title program. Refer to the Admission Requirements section of the Operations Research Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>). Doctoral students must be admitted into the dual-title degree program in Operations Research prior to taking the qualifying exam in their home department.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Business Administration, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual-title in Operations Research, listed on the Operations Research Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>).

For the dual-title M.S. degree in Business Administration and Operations Management, the thesis or scholarly paper must reflect the student's education and interest in both Business Administration and Operations Research. The master's committee must include at least one Graduate Faculty member from Operations Research. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role.

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Business Administration and must include at least one Graduate Faculty member from the Operations Research program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Business Administration and Operations Management. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Business Administration and Operations Research

dual-title Ph.D. student must include at least one member of the Operations Research Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Operations Research, the member of the committee representing Operations Research must be appointed as co-chair. The Operations Research representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Business Administration and Operations Research. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Integrated Undergrad-Grad Programs

Integrated B.S. in Science and M.B.A. in Business Administration

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

This program is the result of collaboration between the Eberly College of Science and Smeal College of Business. With the accelerated nature of the program, students can earn a B.S. degree in science and an M.B.A. degree in five calendar years after graduation from high school. For the first three and one-half years, including the first semester of the M.B.A. curriculum, students are enrolled as undergraduates in the Eberly College of Science. For the remaining three semesters, participants are graduate students formally enrolled in the Smeal College of Business M.B.A. program. Successful completion of this program results in a B.S. degree in Science awarded by the Eberly College of Science during year four and an M.B.A. from the Smeal College of Business at the end of year five.

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students must apply to the program via the Graduate School application for admission (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet all the admission requirements of the Graduate School and the Business Administration graduate program for the Master of Business Administration degree. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.

In consultation with an adviser, students must prepare a plan of study appropriate to this integrated program, and must present their plan of study to the head of the graduate program or the appropriate committee overseeing the integrated program prior to being admitted to the

program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.

Students must fulfill all requirements for each degree in order to be awarded that degree. Degree requirements for the B.S. degrees can be found in the Undergraduate Degree Program Bulletin (<http://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.B.A. degree are listed on the Degree Requirements tab.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
BA 512	Quantitative Analysis for Managerial Decision Making	2
BA 800	Marketing Management	2
BA 801	Management	2
BA 811	Financial Accounting	2
BA 815	Business Statistics for Contemporary Decision Making	2
BA 831	Foundations in Finance	2

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.B.A. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Joint Degrees

Joint J.D./M.B.A. with Penn State Law

Requirements listed here are in addition to requirements listed in GCAC-211 Joint Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-211-joint-degree-programs/>).

Smeal College of Business and the Penn State Law offer a joint degree program leading to the degrees of Juris Doctor (J.D.) and Master of Business Administration (M.B.A.). We live in a global society where complex legal structures interact with dynamic and powerful market forces. Individuals with backgrounds in both business and law have a distinct advantage in understanding this interaction and are uniquely positioned for success in our modern society. The Juris Doctor/Master of Business Administration (J.D./M.B.A.) joint degree program provides outstanding, highly motivated students the opportunity to combine a Juris Doctor degree from Penn State Law with an M.B.A. degree from Penn State's internationally ranked Smeal MBA Program (Smeal). Participants in this program earn both a Juris Doctor degree and a Master of Business Administration in four years.

In order to be admitted to the program, students must first be admitted and enrolled in Penn State Law and subsequently admitted to the Smeal College of Business.

Admission Requirements

Candidates must apply to Penn State Law and Smeal separately and must meet each school's requirements. The admission requirements for the Master of Business Administration degree are listed on the Admission Requirements tab. Admissions requirements and applications for admission for Penn State Law are available at the J.D. Admissions (<https://www.pennstatelaw.psu.edu/penn-state-law-jd-admissions/>) section of the Penn State Law website.

Degree Requirements

Credit Requirements: Students must fulfill all requirements for each degree in order to be awarded that degree. Seven credits of coursework from the J.D. program, identified in consultation with the graduate program, will be double counted towards the M.B.A. degree requirements. Degree requirements for the J.D. program are listed on the Penn State Law website (<https://www.pennstatelaw.psu.edu/jd-degree-requirements/>). Degree requirements for the M.B.A. degree are listed on the Degree Requirements tab.

Advising of Students: All students in the program shall have two advisers, one from Smeal and one from Penn State Law. Periodic interaction between the two advisers is encouraged.

Graduation: If students accepted into the joint degree program are unable to complete the J.D. degree, they are still eligible to receive the M.B.A. degree if all the M.B.A. degree requirements have been satisfied.

Joint M.D./M.B.A. with the College of Medicine

Requirements listed here are in addition to requirements listed in GCAC-211 Joint Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-211-joint-degree-programs/>).

Smeal College of Business and the Penn State Hershey College of Medicine offer a joint degree program leading to the degrees of Medical Doctor (M.D.) and Master of Business Administration (M.B.A.). The objective of the program is to produce highly qualified clinicians who also understand the challenges of running a business. The Medical Doctor/Master of Business Administration (M.D./M.B.A.) joint degree program provides outstanding students the opportunity to combine a Medical Doctor degree from the College of Medicine, a highly respected medical college and medical center, with an M.B.A. degree from Penn State's internationally ranked Smeal MBA Program (Smeal). Participants in this program earn both a Medical Doctor degree and a Master of Business Administration in five years.

In order to be admitted to the program, students must first be admitted and enrolled in the COM as a medical student and subsequently admitted to Smeal. Each program will make a separate admission decision. Students admitted to both programs will be admitted as joint degree candidates.

Students currently enrolled at the College of Medicine in the M.D. program may apply to the M.D./M.B.A. program during their first three years at the College of Medicine by applying to the M.B.A. program, as described on the Admission Requirements tab.

Admission Requirements

The admission requirements for the Master of Business Administration degree are listed on the Admission Requirements tab. Admissions requirements and applications for admission for Penn State College of

Medicine are available at the M.D. Program (<http://www.med.psu.edu/md/>) section of the Penn State College of Medicine website.

Degree Requirements

Credit Requirements: Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Seven credits of coursework from the M.D. program, identified in consultation with the graduate program, will be double counted towards the M.B.A. degree requirements. Degree requirements for the M.D. program are listed on the College of Medicine website (<http://www.med.psu.edu/md/>). Degree requirements for the M.B.A. degree are listed on the Degree Requirements tab.

Sequence: Students may choose to conduct their study in either of the two sequences shown below. Each "Year" refers to the traditional academic year beginning in late August and concluding in May. The College of Medicine students can expect to take courses during the summer. The Smeal College of Business does not offer any classes over the summer term.

Years 1-3: M.D. foundation and advanced course work at the College of Medicine.

Year 4: M.B.A. course work at the University Park location.

Year 5: Return to M.D. course work at the College of Medicine.

Advising of Students: All students in the program shall have two advisers, one from the Smeal College of Business and one from the College of Medicine. Periodic interaction between the two advisers is encouraged.

Graduation: If students accepted into the joint degree program are unable to complete the M.D. degree, they are still eligible to receive the M.B.A. degree if all the M.B.A. degree requirements have been satisfied.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course

load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Students applying to the M.B.A. program are eligible for Fellowships and Scholarships which are awarded by the Smeal College of Business at the time of admission. Graduate assistantships are not available to students in this program due to course load limits set by The Graduate School.

In addition to the fellowships, traineeships, graduate assistantships, and other forms of financial aid described on the Graduate School's website (<http://gradschool.psu.edu/graduate-funding/>), other awards are available to graduate students in Smeal College of Business.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Business Administration (BA) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/ba/>)

Contact

Master of Science (M.S.) and Doctor of Philosophy (Ph.D.)

Campus	University Park
Graduate Program Head	Brent William Ambrose
Program Contact	Dana Rae Campolongo 351 Business Building University Park PA 16802 drc21@psu.edu (814) 865-7669
Program Website	View (https://www.smeal.psu.edu/phd/master-of-business-administration-1/)

Master of Business Administration (M.B.A.) and Doctor of Business Administration (D.B.A.)

Campus	University Park
Graduate Program Head	Brian Harold Cameron
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Jeanette K Miller
Program Contact	Andrea Lyn Murphy-Faust 220 Business Building University Park PA 16802 alm205@psu.edu (814) 863-0474
Program Website	View (https://dba.smeal.psu.edu/)

Business Analytics

Graduate Program Head	Kevin Linderman
Program Code	BAN
Campus(es)	University Park (M.B.An.)
Degrees Conferred	Master of Business Analytics (M.B.An.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=BAN)

The Master's in Business Analytics program focuses on developing the business analytics skills of professionals entering and engaged in business, non-business, and STEM career fields. Advances in technology have greatly enhanced the ability of organizations to capture large sets of structured and unstructured data; however, society's ability to organize, prepare, analyze, and exploit such data has not kept pace with these developments. Companies, governments, and nongovernmental organizations now seek qualified employees who can apply mathematics, statistics, computer science, and operations research techniques to small and large data sets to develop insights that will enhance business decision-making capabilities.

In order to develop highly-skilled business analysts capable of supporting data-driven business decisions, the M.B.An. program is built upon the widely-recognized progression of analytics development: descriptive, predictive, and prescriptive analytics. Through descriptive analytics (i.e., "What *has* happened?"), students develop skills in acquiring, organizing, cleaning, visualizing, and analyzing data from a wide range of business and non-business scenarios to help organizations understand their current operations. Advancing to predictive analytics (i.e., "What *will* happen?"), students use cutting-edge techniques (e.g., data mining) to detect patterns in data and project future outcomes based on past events. The M.B.An. program culminates with students learning prescriptive analytics (i.e., "What *should* happen?") skills, where students practice advanced analytics techniques such as simulation and optimization to help develop the best data-driven courses of action for complex business problems. Throughout the program, the curriculum requires students to apply theories, quantitative techniques, and academic research while thinking critically to solve "real" business problems. Group and individual assignments will challenge students to analyze case studies, build models, and communicate their solutions in both written and verbal form.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Applicants must:

- Submit a completed online Graduate School Application for Admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>), including short admissions essay, resume, and three references with complete contact information.
 - Résumé reflecting relevant professional experience including internships and co-op experiences.

- Submit official transcripts from all post-secondary institutions attended (<http://gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>).

GMAT and/or GRE scores will not be required for admission. Accordingly, these scores will not be accepted.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of Business Analytics (M.B.An.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Total credits required for the Master's in Business Analytics program is 30 credits at the 500- or 800-level, with at least 6 credits at the 500-level. One two- or three-credit elective course is required; this course may be at the 500- or 800-level.

There are 30 specified credits comprised of the following courses:

Code	Title	Credits
Required Courses		
BAN 830	Descriptive Analytics for Business	3
BAN 831	Business Data Visualization for Decision Making	3
BAN 832	Programming Skills for Business Analytics	3
BA 840	Business Data Management	3
BAN 840	Predictive Analytics for Business	3
BAN 841	Data Mining for Business	3
BA 804	Ethical Leadership	2
BA 817	Communication Skills for Management	2
BAN 550	Prescriptive Analytics for Business	3
Electives		2-3
Elective courses can be chosen from a list of approved courses maintained by the graduate program office. The list of elective courses may change over time based on feedback from students and industry.		
Culminating Experience		
BAN 888	Implementing Analytics for Business (Capstone Course)	3
Total Credits		30

Capstone

The Master's in Business Analytics program culminates with the project-based capstone course, BAN 888 Implementing Analytics for Business. BAN 888 allows students to apply their newly-developed business analytics problem-solving skills in real-world contexts. Topics include business and analytics problem framing; data sourcing, cleaning, and integration; analysis methodology selection; model building; model deployment; and model lifecycle management. A special emphasis is placed on communicating problems, methodologies, and solutions to executives not trained in statistics and other analytics disciplines.

In BAN 888, students explore each topic in a real-world context, developing business analytics solutions to an ongoing course project in a team setting. Topics in the capstone course align with the body of knowledge in the Institute for Operations Research and the Management Sciences (INFORMS) Certified Analytics Professional Study Guide, while the overall program prepares students who wish to pursue an Associate Certified Analytics Professional (aCAP) or Certified Analytics Professional (CAP) certification through the INFORMS-affiliated Certified Analytics Professional Program, depending on their level of professional analytics experience.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Refer to the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students in this program are not eligible for graduate assistantships.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

The Master's in Business Analytics program Learning Goals and Objectives include:

1. Broad Core of Analytics Knowledge

M.B.An. graduates will master a broad core of analytics knowledge and be able to integrate and apply this knowledge to business situations as corporate managers and strategic partners in industries requiring interdisciplinary skills and global perspectives.

Learning Objectives:

- M.B.An. graduates will demonstrate advanced competency in the underlying concepts, theory, and tools taught in core business analytics programs.
- M.B.An. graduates will be prepared to apply their knowledge of descriptive, predictive, and prescriptive analytics to identify, analyze, and recommend solutions to complex corporate strategic problems and projects requiring interdisciplinary and global perspectives.

2. Analytical and Critical Thinking Skills

MBAN graduates will develop analytical and critical thinking skills needed to excel in today's business environment.

Learning Objectives:

- M.B.An. graduates will acquire the analytical and critical thinking skills needed to identify, analyze, and evaluate alternative solutions to problems and projects facing today's corporate managers and strategic planners.
- M.B.An. graduates will develop the skills needed to craft and implement unique and "cutting edge" strategic and tactical plans.
- M.B.An. graduates will be able to articulate and defend their analyses and recommended solutions to multiple audiences from business, government, and the community.
- M.B.An. graduates will be able to integrate findings and analyses from cutting edge academic and practitioner research to problems and projects confronting corporate America.

3. Interpersonal Skills

M.B.An. graduates will possess the interpersonal skills needed to impress hiring managers and become effective corporate managers and leaders.

Learning Objectives:

- M.B.An. graduates will be skilled at leadership, team building, interpersonal influence, and the management of change.
- M.B.An. graduates will be able to communicate and work effectively with others in work settings involving cultural and demographic diversity.
- M.B.An. graduates will become natural team leaders with the unique ability to identify and limit the phenomenon of "group think" that often plagues underperforming corporations. Graduates will draw out the high potential from their team members, leveraging the team's ability to analyze problems from many points of reference.

4. Value System

MBAN graduates will be able to evaluate the ethical and societal implications of the corporate strategic decision-making for which they are involved and responsible.

Learning Objectives:

- M.B.An. graduates will be skilled at evaluating the impact of various courses of action on multiple stakeholders, including investors, lenders, customers, and the broader community.

These learning outcomes will be achieved by a combination of lectures by faculty and invited guest lecturers, reading of key literature, individual and team projects, and practical involvement in a business analytics capstone experience.

Contact

Campus	University Park
Graduate Program Head	Kevin Linderman
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Chris Solo
Program Contact	Andrea Lyn Murphy-Faust 220 Business Building University Park PA 16802 alm205@psu.edu (814) 863-0474
Program Website	View (https://mban.smeal.psu.edu/)

Chemical Engineering

Graduate Program Head	Phillip Savage
Program Code	CHE
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Dual-Title Ph.D. and M.S. in Chemical Engineering and Operations Research
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=CHE)

Course offerings and research facilities are available in:

- bioprocessing,
- protein engineering,
- energy and alternative energy,
- catalysis and kinetics,
- fluid mechanics,
- nanotechnology,
- polymer science and engineering,
- process control,
- molecular simulation,
- systems biology,
- optimization.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Scores from the Graduate Record Examination (GRE) are not required for admission; if you already have the GRE scores and wish to provide it, then you can include the scores in your application.

Students should be a graduate of an accredited program in chemical engineering. Graduates with other accredited engineering, mathematics, or physical science majors may be admitted, though alternative program schedules may be required as students will be required to demonstrate graduate level competency in the core chemical engineering disciplines of thermodynamics, reaction and reactor kinetics, and transport. This

may include making up of undergraduate deficiencies without graduate credit. Students with a 3.00 grade-point average or above (on a 4.00 scale) and with appropriate course backgrounds will be considered for admission.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Two tracks are available in the Chemical Engineering M.S. program, a thesis and a non-thesis track. A minimum of 18 course credits (30 credits total) is required of the thesis track, which must also include completion of a research thesis and oral defense of the thesis. A minimum of 21 course credits (30 credits total) is required of the non-thesis track. This track also includes a 7-credit research project during the spring and summer that includes a culminating written paper and presentation.

All M.S. students complete a set of core courses in the fundamental chemical engineering disciplines of thermodynamics, reaction and reactor kinetics, and transport. There is no communication or language requirement. Continuous registration is required for all graduate students until the thesis or final paper is approved.

Doctor Of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A minimum of 30 graduate course credits is required and must include a minimum of 15 credits of 500-series Chemical Engineering courses taken at the University. There is no communication or language requirement. The comprehensive examination consists of a written research proposal or project defended orally after it has been accepted.

Continuous registration is required for all graduate students until the dissertation is approved.

Dual-Titles

Dual-title M.S. and Ph.D. and in Chemical Engineering and Operations Research

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admissions Requirements

Students must apply and be admitted to the graduate program in Chemical Engineering and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Operations Research dual-title program. Refer to the Admission Requirements section of the Operations Research Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>). Doctoral students must be admitted into the dual-title degree program in Operations Research prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Chemical Engineering, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual-title in Operations Research, listed on the Operations Research Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Chemical Engineering and must include at least one Graduate Faculty member from the Operations Research program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Chemical Engineering and Operations Research. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Chemical Engineering and Operations Research dual-title Ph.D. student must include at least one member of the Operations Research Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Operations Research, the member of the committee representing Operations Research must be appointed as co-chair. The Operations Research representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Chemical Engineering and Operations Research. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)

- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Chemical Engineering (CHE) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/che/>)

Contact

Campus	University Park
Graduate Program Head	Phillip E Savage
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Robert Rioux
Program Contact	Jennie K Gibson Chemical Biomedical Engineering Building Suite 121A University Park PA 16802 jkb112@psu.edu (814) 865-2575 View (http://www.che.psu.edu/)
Program Website	

Chemistry

Graduate Program Head	Philip Bevilacqua
Program Code	CHEM
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Dual-title Ph.D. in Chemistry and Astrobiology Dual-title Ph.D. in Chemistry and Biogeochemistry
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=CHEM)

The Ph.D. program in Chemistry provides students with a broad background in chemistry and intensive research experience culminating in the preparation of a formal thesis. The goal of the program is to prepare students for a variety of careers in academia, government, or industry. The exceptionally high quality of our laboratory and

computer facilities enables us to provide students with outstanding research opportunities. Distinguished visiting scholars conduct informal discussions each week at a departmental colloquium.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

For admission, at least integral calculus plus one year's work in general physics, organic chemistry, physical chemistry, and either analytical or inorganic chemistry are normally required. Students who have appropriate course backgrounds and who present a 2.50 average (on a 4.00 scale) in all undergraduate courses in chemistry, physics, and mathematics will be considered for admission. The best-qualified applicants will be accepted up to the number of spaces that are available for new students. Exceptions to the minimum 2.50 grade-point average may be made for students with special backgrounds, abilities, and interests. GRE scores are not required and will not be used in the admissions decision process.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A minimum of 30 credits at the 400, 500, or 800 level is required, with at least 18 credits at the 500 and 600 level, combined. CHEM 431W, CHEM 450, CHEM 452, CHEM 457, CHEM 494, and CHEM 500 cannot be applied towards the M.S. degree requirements. Students who choose to complete a scholarly paper as the culminating experience must complete 18 credits at the 500 level. All candidates for advanced degrees must schedule CHEM 602, Supervised Experience in College Teaching, for at least 1 credit for at least one semester; however, this 1 credit cannot be counted towards the minimum credits required for the degree.

M.S. students must complete either a thesis or a scholarly paper as the culminating experience for the degree. Students who choose to write a thesis must defend the thesis at an oral examination. The thesis will be accomplished under the sponsorship of a faculty member, and the candidate must take 12 credits of CHEM 600 in conjunction with the thesis. A maximum of 6 credits of CHEM 600 may be awarded a quality grade. The thesis must be approved by a committee of at least three faculty members, one of whom will be the candidate's sponsor. The thesis must also be accepted by the head of the graduate program and the Graduate School, and the student must pass the thesis defense. A final oral examination will be administered by a committee consisting of the student's research preceptor and two other faculty members. This examination is scheduled after the M.S. thesis has been completed. Students who choose to complete a scholarly paper enroll in CHEM 589 (12 credits).

Examinations in analytical, biological, inorganic, organic, and physical chemistry will be given to all new students upon entrance in the fall semester. These exams cover subject matter at the level of the basic courses offered for the B.S. degree in Chemistry at Penn State. For certification as an M.S. student, proficiency in two areas is required. Such proficiency may be demonstrated either by (1) passing the area

examination upon entrance, or (2) obtaining a grade-point equivalent of 3.0 in at least 3 credits of 500-level course work in the area. The courses used to fulfill this latter option will be designated by the graduate counseling committee. This course work must be completed successfully during the student's first two semesters of residence.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Candidates for the Ph.D. degree in Chemistry must meet the following requirements established by the department faculty.

A Ph.D. student must take a minimum of five 3-credit courses in chemistry at the 400 or 500 level. The student's Ph.D. committee may require additional specific courses.

All candidates for advanced degrees must schedule CHEM 602, Supervised Experience in College Teaching, for at least 1 credit for at least one semester; however, this 1 credit cannot be counted towards the minimum credits required for the degree.

Examinations in analytical, biological, inorganic, organic, and physical chemistry will be given to all new students upon entrance in the fall semester. These exams cover subject matter at the level of the basic courses offered for the B.S. degree in Chemistry at Penn State. As a part of the requirements for certification as a Ph.D. student, each student will be expected to demonstrate proficiency in three areas of chemistry. Such proficiency may be demonstrated either by (a) passing the area examination upon entrance, or (b) obtaining a grade-point equivalent of 3.0 in at least 3 credits of 500-level course work in the area. The courses used to fulfill this latter option will be designated by the graduate counseling committee. This course work must be completed successfully during the student's first two semesters of residence.

In order to qualify for the oral comprehensive examination, a Ph.D. student must first obtain a grade of 3.0 or better on 4 credits of CHEM 500 (by writing the requisite number of seminar reports, proposals, and presenting in an area seminar).

A Ph.D. student must pass the oral comprehensive examination during his or her first two and one-half years of residency.

Every Ph.D. student shall present at least one area or department seminar during the course of residency.

A final oral examination based on a defense of the doctoral dissertation is required of all candidates. This exam is given as a formal public seminar with a subsequent closed meeting with the Ph.D. committee. To earn the Ph.D. degree, doctoral students must write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School, and the student must pass the final oral examination (the dissertation defense).

Dual-Titles

Dual-Title Ph.D. in Chemistry and Biogeochemistry

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Graduate students with research and educational interests in biogeochemistry may apply to the Biogeochemistry Dual-Title Degree Program. Students in the Biogeochemistry Dual Title program are required to have two advisers from separate disciplines: one individual serving as a primary adviser in their major degree program and a secondary adviser in an area within a field covered by the dual-title program and a member of the Biogeochemistry faculty.

Students must apply and be admitted to the graduate program in Chemistry and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Biogeochemistry dual-title program. Refer to the Admission Requirements section of the Biogeochemistry Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/biogeochemistry/>). Doctoral students must be admitted into the dual-title degree program in Biogeochemistry prior to taking the qualifying examination in their primary graduate program.

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Chemistry and must include at least one Graduate Faculty member from the Biogeochemistry program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Chemistry and Biogeochemistry. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Chemistry and Biogeochemistry dual-title Ph.D. student must include at least one member of the Biogeochemistry Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Biogeochemistry, the member of the committee representing Biogeochemistry must be appointed as co-chair. The Biogeochemistry representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Chemistry and Biogeochemistry. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-title Ph.D. in Chemistry and Astrobiology

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Students must apply and be admitted to the graduate program in Chemistry and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Astrobiology dual-title program. Refer to the

Admission Requirements section of the Astrobiology Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/astrobiology/>). Doctoral students must be admitted into the dual-title degree program in Astrobiology no later than the end of the fourth semester (not counting summer semesters) of entry into the graduate major program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the Chemistry degree, listed in the Degree Requirements section. In addition, students must complete the degree requirements for the dual-title in Astrobiology, listed on the Astrobiology Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/astrobiology/>). The Qualifying Examination in the major area alone will satisfy the Qualifying Exam requirement for the dual-title program. In addition to the general Graduate Council requirements for Ph.D. committees (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>), the Ph.D. committee of a Chemistry and Astrobiology dual title Ph.D. student must include at least one member of the Astrobiology Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Astrobiology, the member of the committee representing Astrobiology must be appointed as co-chair. The Astrobiology representative on the student's Ph.D. committee will participate in the evaluation of the comprehensive examination. Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Chemistry and Astrobiology. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/>)

gsad/gsad-900/gsad-901-graduate-assistants/) set by The Graduate School.

It is important to note that department policy limits financial support from department funds to the first two years of graduate study of an M.S. candidate and to the first five years of graduate study of a Ph.D. candidate. Financial support beyond these periods is permitted from other than department funds, e.g., a research assistantship funded from an individual faculty member's research grant(s).

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Chemistry (CHEM) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/chem/>)

Learning Outcomes

1. Know: Graduates will exhibit appropriate depth and breadth of chemistry knowledge, both of core principles as well as theories and methods in their chosen sub-discipline(s).
2. Apply/Create: Graduates will use chemistry-based methods and techniques to create new knowledge, and to apply that knowledge to problem solving tasks.
3. Communicate: Graduates will be able to convey their chemical knowledge via effective written and verbal communication skills.
4. Think: Graduates will employ satisfactory analytical and critical thinking, and creativity, within Chemistry.
5. Professional Practice- ethical and professional behavior: Graduates will demonstrate ethical best practices for chemistry research, interact collegially with peers, and seek to promote productive collaborations as part of their graduate and professional work..

Contact

Campus	University Park
Graduate Program Head	Philip C Bevilacqua
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	John B Asbury
Program Contact	Shannon Chappell 104 Chemistry Building University Park PA 16802 smg211@psu.edu (814) 865-1383
Program Website	View (https://science.psu.edu/chem/graduate/)

Civil Engineering (Capital)

Graduate Program Head	Vahid Motevalli
Program Code	CENG
Campus(es)	Harrisburg (M.S.)
Degrees Conferred	Master of Science (M.S.) Integrated B.S. in Civil Engineering and M.S. in Civil Engineering
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=CENG)

Both the United States' and Pennsylvania's infrastructure have been given poor grades in the latest infrastructure report cards by the American Society of Civil Engineers. The next generation of civil engineers will be tasked with repairing and modernizing existing horizontal and vertical infrastructure to ensure that it is safe, sustainable, and resilient in the face of current and future hazards. We also will need to build out new infrastructure to accommodate the needs of people and businesses, all while keeping the protection of public health and safety at the forefront of our designs. This will require not just the strong understanding of structural, environmental, transportation, geotechnical, construction, and water resources fundamentals, but also the ability to apply modern design principles and tools to solve these wicked challenges of the future.

The Master's of Science in Civil Engineering at Penn State Harrisburg is designed to ensure that you are prepared to meet these challenges in your specialty area of civil engineering: structural, transportation, and/or water resources. The program can accommodate the needs of working professionals, as well as full-time students, with most classes offered in the evening. Some classes are offered in a hybrid or web format so that students do not have to commute to campus every week. Strong connections with local industry and with government agencies allows the faculty to bring experts into classes to create connections and allow students to understand how their master's degree is immediately useful in the profession. Updated laboratories and computing facilities support classroom experiences and student research.

For students wishing to focus in environmental and water resources engineering, they can select this option. The option ensures that Environmental and Water Resources Engineering will be listed on their transcript to highlight this focus.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Admission into the Master of Science (M.S.) Civil Engineering program will be granted only to candidates who demonstrate high potential for success in graduate studies. Applicants should have undergraduate degrees in engineering or technology-related fields from an accredited university and must meet the admission requirements as set by Penn State's Graduate School. For admission, an undergraduate cumulative grade-point average of 3.0 or better on a 4.0 scale. Scores from the GRE are required for those who indicate an interest in a school/college-funded assistantship.

Exceptions to the minimum 3.00 grade-point average may be made for students with special backgrounds, abilities, and interests. Students with a baccalaureate degree in non-civil engineering and engineering technology could be admitted on a provisional basis (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-303-provisional-admission/>) pending successful completion of prerequisite courses within 1-2 semesters of admission.

Applicants should submit the following:

- a completed Graduate School online application with the application fee;
- official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>);
- three (3) letters of professional recommendations from individuals who can evaluate the applicant's potential;
- a personal statement of professional interest, goals, and experience;
- test scores from the Graduate Record Examination (GRE); and
- a statement of interest in a graduate assistantship, if desired (full-time study required).

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Prerequisite Courses

Students may be admitted to the program from various engineering/engineering technology disciplines. Students applying for admission are expected to have B.S. degree in engineering/engineering technology and completed the following core courses:

- Physics I and II (one year of college physics);
- Calculus I and II (differential and integral calculus);
- Differential equations;
- Chemistry (one semester);
- Statics;
- Dynamics; and
- Strength of materials.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

All graduate students in Civil Engineering are required to adhere to the requirements of the Graduate School, as found in the Graduate Degree Programs Bulletin. The requirements of the Graduate School, however, are minimum requirements and the policies, procedures, and regulations listed below are additional and more specific for graduate students pursuing the M.S. in Civil Engineering degree. Advisers will call pertinent regulations to the attention of their advisees, but it should be understood that it is the student's personal responsibility to see that all requirements are satisfied.

The M.S. CE program at PSH is structured to take full advantage of the specialty areas of expertise of the CE Graduate Faculty. The M.S. degree with the thesis track requires 31 credits at the 400, 500, 600, or 800 level, including 24 course credits with at least 12 credits at the 500 level, one colloquium credit (CE 590), and six thesis credits (CE 600 or CE 610). The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School, and the student must pass a thesis defense.

The M.S. degree with the non-thesis track also requires 31 credits at the 400, 500, or 800 level, including 27 course credits with at least 15 credits at the 500 level, one colloquium credit (CE 590), and three research/paper credits (ENGR 594).

All M.S. CE students are required to take an advanced math or statistics course (EMCH 524A or STAT 500), and EMCH 500 or CE 437, and colloquium (CE 590). Students will take 12 (thesis) or 15 (non-thesis) credits of civil engineering courses, selected from offerings in structural, construction, transportation, water resources, and environmental with 9 (thesis) or 12 (non-thesis) credits at the 500-level.

Elective Courses. Students will take six (6) additional elective credits at either the 400- or 500-level. These electives may be taken from civil engineering courses or courses offered by other departments that meet the objective of the M.S. CE degree. The student can work with their adviser to select courses that either focus on a specific area of civil engineering or that provide a robust in-depth background of multiple areas of civil engineering. A maximum of four 400-level courses (12 credits) may be taken for the M.S. CE degree.

Culminating Experience. For a thesis, original research, requiring at least two semesters of work (up to 6 credits), is expected. The work should be an in-depth investigation intended to extend the state of knowledge in a specialty area. The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School, and the student must pass a thesis defense. For the non-thesis track, a scholarly paper is required while the student is enrolled in ENGR 594. The paper should be an inquiry in a specialty area. The paper must be accepted by the advisers and/or committee members, the head of the graduate program, and the student must pass the paper defense.

Additional Requirements. A maximum of three credits of independent study (CE 596) may be applied towards the M.S. CE degree program, but the undergraduate individual study course (CE 496) will not count towards program credit requirements.

All students are expected to complete one credit of colloquium (CE 590) during the first two semesters of study. Degree requirements must be completed during a six-year period.

Penn State Harrisburg's M.S. CE program is distinct and independent of the M.S. CE program offered at the University Park campus.

Environmental Option

Code	Title	Credits
Core Courses		
EMCH 524A or STAT 500	Mathematical Methods in Engineering Applied Statistics	3
EMCH 500 or CE 437	Solid Mechanics Engineering Materials for Sustainability	3
Required Environmental Option Courses		
ENVE 591	Research Methods in Environmental Engineering	1

ENVE 569	Environmental Risk Assessment	3
Select 3 credits of environmental chemistry or biology from the following list:		3
CE 570	Environmental Aquatic Chemistry	
ENVE 540	Biodegradation and Bioremediation	
ENVE 550	Chemical Fate and Transport	
Select 3 credits of design engineering in environmental and water resources:		3
ENVE 411	Water Supply and Pollution Control	
ENVE 415	Hydrology	
ENVE 417	Hydraulic Design	
CE 462	Open Channel Hydraulics	
CE 555	Groundwater Hydrology: Analysis and Modeling	
CE 571	Physical-Chemical Treatment Processes	
CE 572	Biological Treatment Processes	
Total Credits		16

Integrated Undergrad-Grad Programs

Integrated B.S. in Civil Engineering and M.S. in Civil Engineering

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Civil Engineering with the M.S. in Civil Engineering offered at the following campuses:

Undergraduate Degree

- Harrisburg
- University Park

Graduate Degree

- Harrisburg

The graduate portion of this IUG is currently offered as face-to-face residential instruction. While the undergraduate curriculum for this IUG may be completed at multiple campuses, the ease and feasibility of completing the integrated program may be heavily dependent upon the location of the graduate instruction. Please discuss the feasibility of completing the IUG with a representative for the graduate program.

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The Civil Engineering program offers a limited number of academically superior Bachelor of Science candidates the opportunity to enroll in an integrated, continuous program of study leading to both the Bachelor of Science and the Master of Science in Civil Engineering. The ability to coordinate as well as concurrently pursue the two degree programs enables students to earn the two degrees in five years.

Students in the IUG program must satisfy the degree requirements for both Bachelor of Science and Master of Science degrees. However, the total course load is reduced due to the maximum of 12 credits that can count towards both degrees. A minimum of 6 credits proposed to count for both degrees must be at the 500 level. Thesis, master's paper, and undergraduate capstone credits may not be double counted. The fourth year of the IUG program differs from the fourth year of the Bachelor of

Science program due to the courses that count toward the Master of Science Degree requirements.

Student performance will be monitored on an on-going basis. In addition, a formal evaluation of a student's academic performance will be conducted at the end of the first semester of the senior year for a typical program student. Students who have not maintained a 3.0 retention GPA in their Math and Civil (CE/ENVE) Engineering courses will be put on probationary status with respect to the IUG program. Their ability to continue in the IUG program will be based on academic performance in the last semester of their fourth year. As part of the review in the fourth year, students will be advised about the thesis or master's paper requirement in the graduate program.

If for any reason a student admitted to the IUG program is unable to complete the requirements for the Master of Science degree, the student will be permitted to receive the Bachelor of Science degree assuming all the undergraduate degree requirements have been satisfactorily completed. If students successfully complete courses listed in the recommended schedule, they will satisfy the requirements for the Bachelor of Science degree by the end of their fourth year.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students must apply to the program via the Graduate School application for admission (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet all the admission requirements of the Graduate School and the Civil Engineering graduate program for the Master of Science degree, listed in the Admission Requirements section. Students must submit:

- an official transcript
- three letters of professional recommendation from individuals who can evaluate the applicant's potential
- a personal statement of technical interest and goals

A faculty adviser will help undergraduate candidates determine a sequence of courses that will prepare them for acceptance into the Integrated Undergraduate-Graduate (IUG) degree program. In order to apply for this IUG program, students must have completed entrance to the undergraduate major and a minimum of 83.5 credits; therefore, a typical student would apply after completing the fifth semester and before the end of the sixth semester. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. For consideration for acceptance into the program, students must have an admissions cumulative grade point average (GPA) of 3.3 or better and an admissions collective GPA of 3.3 or better in the following courses:

Code	Title	Credits
CE 310	Surveying	
CE 335	Engineering Mechanics of Soils	
CE 336	Materials Science for Civil Engineers	
CE 340	Structural Analysis	
CE 360	Fluid Mechanics	

CE 370	Introduction to Environmental Engineering
And all the designated MATH and EMCH courses	

Applications will be evaluated based on the students' overall academic performance, in addition to the above requirements. In all cases, admission to the program will be at the discretion of the Graduate Admissions Committee of the Civil Engineering program.

Degree Requirements

Students must fulfill all degree requirements for each degree to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Science in Civil Engineering are listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>). Degree requirements for the Master of Science in Civil Engineering degree are listed on the Degree Requirements tab. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted. The double-counted classes (required and elective) are listed below:

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
<i>Math Core Requirements</i>		
EMCH 524A	Mathematical Methods in Engineering	3
or STAT 500	Applied Statistics	
<i>Materials</i>		
EMCH 500	Solid Mechanics	3
or CE 437	Engineering Materials for Sustainability	
<i>Electives</i>		
CE 422	Transportation Planning	3
CE 423	Traffic Operations	3
CE 424	Project Info. Modeling	3
CE 434	Geotechnical Engineering Design	3
CE 435	Foundation Engineering	3
CE 436	Construction Engineering Materials	3
CE 441	Structural Design of Foundations	3
CE 445	Advanced Structural Analysis	3
CE 447	Structural Analysis by Matrix Methods	3
CE 449	Advanced Structural Design	3
CE 456	Planning and Scheduling	3
CE 458	Construction Management II	3
CE 462	Open Channel Hydraulics	3
ENVE 411	Water Supply and Pollution Control	3
ENVE 415	Hydrology	3
ENVE 417	Hydraulic Design	3
ENVE 430	Sustainable Engineering	3
CE 511	Engineering Soil Characteristics	3

CE 512	Soil Mechanics II	2-5
CE 521	Transportation Networks and Systems Analysis	3
CE 522	Traffic Flow Theory and Simulation	3
CE 523	Analysis of Transportation Demand	3
CE 525	Transportation Operations	3
CE 526	Highway and Street Design	3
CE 528	Transportation Safety Analysis	3
CE 529		
CE 539	Approximate Methods of Structural Analysis	3
CE 540	Statically Indeterminate Structures	3
CE 541	Structural Analysis	3
CE 543	Prestressed Concrete Behavior and Design	3
CE 544	Design of Reinforced Concrete Structures	3
CE 545	Metal Structure Behavior and Design	3
CE 548	Structural Design for Dynamic Loads	3
CE 549	Bridge Engineering I	3
CE 550	Engineering Construction Management	3
CE 555	Groundwater Hydrology: Analysis and Modeling	3
CE 566	Uncertainty and Reliability in Civil Engineering	3
CE 570	Environmental Aquatic Chemistry	3
CE 571	Physical-Chemical Treatment Processes	3
CE 572	Biological Treatment Processes	3
CE 581	Pavement Management and Rehabilitation	3
CE 582	Pavement Design and Analysis	3
CE 583	Bituminous Materials and Mixtures	3
CE 584	Concrete Materials and Properties	3
ENVE 540	Biodegradation and Bioremediation	3
ENVE 550	Chemical Fate and Transport	3
ENVE 569	Environmental Risk Assessment	3

The MSCE faculty has established a six-year time limit for completion of the M.S. degree. Any extension beyond six years requires the approval of the program's Graduate Faculty.

Students must maintain a minimum retention grade point average (GPA) of 3.00 or better on a 4.00 scale in 500- and 400-level courses listed on their Plan of Study.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)

- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Students are encouraged to talk to the faculty in the program to discuss opportunities to assist in research whether part-time or full-time.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Civil Engineering (CE) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/ce/>)

Learning Outcomes

1. **KNOW:** Graduates will be able to demonstrate broad mastery of core principles in resilient and sustainable civil infrastructure engineering as well as in-depth mastery in one concentration area (structural, transportation, environmental/water resources).
2. **THINK:** Graduates will be able to critically and creatively conceptualize, evaluate and formulate civil infrastructure engineering problems, as well as perform the analyses required for problem definition. All MSCE courses are taught with a significant design component that builds on the theory that students learn throughout their education. The graduate courses provide the class time for in-depth study of a specific area of civil engineering that does not occur in the undergraduate degree where the topic may be part of a larger course.
3. **APPLY/CREATE:** Graduates will be able to apply advanced knowledge, techniques, skills, and state of the practice tools to solve civil infrastructure engineering problems. In class, MSCE students are exposed to relevant challenges in the class topic area, such as structural failures, life span/life cycle analysis, flooding, and water pollution, and then, they apply the theory learned in class to solve these problems and to prevent further disasters, especially in a changing climate and where there is pressure to develop in areas that were previously considered unsuitable for urban development.
4. **COMMUNICATE:** Graduates will be able to effectively communicate, both orally and in writing, project outcomes, such as ideas, requirements, designs, analyses, findings, and justification for decisions. MSCE students demonstrate their communication skills by illustrating problem solutions, writing project reports, and presenting observations, conclusions, and recommendations for class and program requirements.
5. **PROFESSIONAL PRACTICE:** Graduates will be able to demonstrate an understanding of professional and ethical responsibility and conduct

themselves accordingly. MSCE students participate in SARI training and in-class ethics and professional licensing discussions. Students demonstrate their professionalism while interacting with instructors, project sponsors, and classmates.

Contact

Campus	Harrisburg
Graduate Program Head	Vahid Motevalli
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Grady F Mathews
Program Contact	Heather Lookenbill Penn State Harrisburg 777 W. Harrisburg Pike, W236 Olmsted Middletown PA 17057 hpl5273@psu.edu (717) 948-4350
Program Website	View (https://harrisburg.psu.edu/science-engineering-technology/civil-structural-construction/masters-science-civil-engineering/)

Civil Engineering (Engineering)

Graduate Program Head	Farshad Rajabipour
Program Code	CE
Campus(es)	University Park (Ph.D., M.S., M.Eng.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Master of Engineering (M.Eng.) Dual-Title Ph.D. in Climate Science Dual-Title Ph.D. and M.S. in International Agriculture and Development Dual-Title Ph.D., M.S., and M.Eng. in Operations Research
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=CE)

Students may specialize in:

- Geotechnical and materials engineering
- Structural engineering
- Transportation engineering
- Water resources engineering

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students in engineering, physical sciences, or mathematics with a 3.00 grade-point average (on a 4.00 scale) may be considered for admission. Exceptions to the minimum 3.00 grade-point average may be made for students with special backgrounds, abilities, and interests. Students without a baccalaureate degree in engineering would be admitted on

a provisional basis (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/provisional-admission/>) pending successful completion of entrance requirements (completed concurrently with degree requirements).

Applicants will upload official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>), a statement of objectives, and three references for letters of recommendation when applying to the program. Submission of GRE scores is recommended but not required. For the M.Eng. degree, the recommendation for GRE scores is waived for students who have graduated with a degree from the College of Engineering at The Pennsylvania State University with a cumulative grade-point average of greater than 3.30.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

APPLICATION DEADLINES

M.Eng.: Complete applications including required supplementary materials (e.g., official transcripts, reference letters) should be submitted by June 1st of the calendar year for admission in Fall semester. International students are strongly encouraged to submit complete applications early to allow sufficient time for visa processing.

M.S. and Ph.D.: Complete applications including required supplementary materials (e.g., official transcripts, reference letters) should be submitted by September 15th for admission in Spring semester and by December 15th for admission in Fall semester. International students are strongly encouraged to submit complete applications early to allow sufficient time for visa processing.

Degree Requirements

Master of Engineering (M.Eng.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The M.Eng. degree is a non-thesis professional master's degree. The program provides training for advanced professional practice. A minimum of 30 credits (400, 500, or 800) of course work is required. At least 18 credits must be earned in 500-level or 800-level courses, with at least 6 credits at the 500 level. At least 12 credits must be earned in courses with the CE prefix. At least 20 credits must be earned at the campus where the program is approved to be offered. All students are required to take the capstone course CE 835 to fulfill the requirement for a culminating experience. The M.Eng. degree is designed as a one-year master's degree program and students are expected to start their degree in the Fall semester. The preferred plan of study is as follows:

- Fall semester: Fifteen credits of course work
- Spring semester: Fifteen credits of course work, including CE 835

Students entering the M.Eng. degree must select and declare an area of specialization, with a number of courses to be selected from the selected area. The three areas of specialization are:

1. Infrastructure
2. Transportation Systems
3. Water and Environment

Continuous registration is required for all M.Eng. students until the course requirements have been satisfied, but students may reapply if studies are interrupted per GCAC-514 Continuity of Registration and Resume Study (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-500/gcac-514-continuity-registration-resume-study/>).

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The M.S. degree program is strongly oriented toward research. A thesis is required, and at least 6 credits of thesis research (CE 600 or CE 610) must be included in the candidate's academic course plan. A minimum of 30 credits at the 400, 500, 600, or 800 level are required, of which 20 must be earned at the campus where the program is approved to be offered. A minimum of 24 credits of course work are required. A minimum of 12 credits of course work (400 and 500 level) must be completed in the major (courses prefixed CE). At least 18 credits in the 500 and 600 levels, combined, must be included in the program. Specific courses are expected to be included in the plan of study depending on the specialization within the department. The thesis must be accepted by the adviser and/or committee members, the head of the graduate program, and the Graduate School, and the student must pass a thesis defense.

Continuous registration is required for all M.S. students until the thesis has been approved, but students may reapply if studies are interrupted per GCAC-514 Continuity of Registration and Resume Study (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-500/gcac-514-continuity-registration-resume-study/>).

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Ph.D. students must pass the English proficiency and qualifying examinations, prepare and defend the dissertation proposal as part of the oral comprehensive examination, and pass the final oral examination (dissertation defense). The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Continuous registration is required for all Ph.D. students until the dissertation has been approved, but students may reapply if studies are interrupted per GCAC-514 Continuity of Registration and Resume Study (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-500/gcac-514-continuity-registration-resume-study/>).

Dual-Titles

Dual-title Ph.D. in Civil Engineering and Climate Science

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Students must apply and be admitted to the graduate program in Civil Engineering and The Graduate School before they can apply for

admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Climate Science dual-title program. Refer to the Admission Requirements section of the Climate Science Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/climate-science/>). Doctoral students must be admitted into the dual-title degree program in Climate Science no later than the end of fourth semester (not counting summer semesters) of entry into the graduate major program and before taking the comprehensive exam.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Civil Engineering, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual-title in Climate Science, listed on the Climate Science Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/climate-science/>).

The qualifying examination for Civil Engineering will satisfy the qualifying exam requirement for the dual-title degree program in Climate Science.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>), the Ph.D. committee of a Civil Engineering and Climate Science dual-title Ph.D. student must include at least one member of the Climate Science Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Climate Science, the member of the committee representing Climate Science must be appointed as co-chair. The Climate Science representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Civil Engineering and Climate Science. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-title M.S. and Ph.D. in Civil Engineering and International Agriculture and Development

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Students must apply and be admitted to the graduate program in Civil Engineering and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the INTAD dual-title program. Refer to the Admission Requirements section of the INTAD Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/international-agriculture-development/>). Doctoral students must be admitted into the dual-title degree program in INTAD prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Civil Engineering, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual-title in INTAD, listed on the INTAD Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/international-agriculture-development/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Civil Engineering and must include at least one Graduate Faculty member from the INTAD program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Civil Engineering and INTAD. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>), the Ph.D. committee of a Civil Engineering and INTAD dual-title Ph.D. student must include at least one member of the INTAD Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in INTAD, the member of the committee representing INTAD must be appointed as co-chair. The INTAD representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Civil Engineering and INTAD. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title M.Eng., M.S., and Ph.D. in Civil Engineering and Operations Research

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Students must apply and be admitted to the graduate program in Civil Engineering and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Operations Research dual-title program. Refer to the Admission Requirements section of the Operations Research Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>). Doctoral students must be admitted into the dual-title degree program in Operations Research prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Civil Engineering, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual-title in Operations Research, listed

on the Operations Research Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Civil Engineering and must include at least one Graduate Faculty member from the Operations Research program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Civil Engineering and Operations Research. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Civil Engineering and Operations Research dual-title Ph.D. student must include at least one member of the Operations Research Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Operations Research, the member of the committee representing Operations Research must be appointed as co-chair. The Operations Research representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Civil Engineering and Operations Research. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

International applicants who wish to be considered for a teaching assistantship must present an acceptable score (250-300 or 55-60) on the Test of Spoken English (TSE). The TSE can be taken in many countries, or at Penn State after arrival. The Department offers a number of graduate fellowships.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Civil Engineering (CE) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/ce/>)

Learning Outcomes

Master of Engineering (M.Eng.)

1. **KNOW:** Graduates will be able to demonstrate understanding of advanced core principles and methods from selected sub-fields of Civil Engineering at a depth consistent with their course of study.
2. **APPLY/CREATE:** Graduates will be able to apply their knowledge of selected sub-fields of Civil Engineering to design and evaluate engineering solutions.
3. **THINK:** Graduates will be able to analyze and synthesize knowledge within the field of Civil Engineering to address a complex problem of practical relevance.
4. **COMMUNICATE:** Graduates will be able to demonstrate proficiency in oral and written communication appropriate to their discipline.
5. **PROFESSIONAL PRACTICE:** Graduates will be able to demonstrate an understanding of, and a commitment to, academic integrity and the standards for professional practice within Civil Engineering.

Master of Science (M.S.)

1. **KNOW:** Graduates will be able to demonstrate understanding of advanced core principles and methods from selected sub-fields of Civil Engineering at a depth consistent with their course of study.
2. **APPLY/CREATE:** Graduates will be able to apply their knowledge of selected sub-fields of Civil Engineering to design and evaluate engineering solutions.
3. **THINK:** Graduates will be able to analyze and synthesize knowledge within the field of Civil Engineering to extend existing knowledge through a research-based culminating experience.
4. **COMMUNICATE:** Graduates will be able to demonstrate proficiency in oral and written communication appropriate to their discipline.

5. **PROFESSIONAL PRACTICE:** Graduates will be able to demonstrate an understanding of, and a commitment to, the standards for scholarship and research integrity within Civil Engineering.

Doctor of Philosophy (Ph.D.)

1. **KNOW:** Graduates will be able to demonstrate an understanding of advanced core principles and methods as well as modern research findings from selected sub-fields of Civil Engineering at a depth appropriate for conceptualizing and conducting independent research.
2. **APPLY/CREATE:** Graduates will be able to apply their knowledge of selected sub-fields of Civil Engineering in formulating and executing a research plan.
3. **THINK:** Graduates will be able to demonstrate the ability to analyze and synthesize appropriate literature, to critically review their work in the context of the literature, and to formulate and defend conclusions based on their research that represent new scholarly contributions.
4. **COMMUNICATE:** Graduates will be able to demonstrate high levels of proficiency in oral and written communication.
5. **PROFESSIONAL PRACTICE:** Graduates will be able to demonstrate an understanding of, and a commitment to, the standards for scholarship and research integrity.

Contact

Campus	University Park
Graduate Program Head	Farshad Rajabipour
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Tong Qiu
Program Contact	Tong Qiu Civil Environmental Engineering 216 Sackett Bldg. University Park PA 16802 tuq1@psu.edu (814) 863-7305
Program Website	View (http://www.engr.psu.edu/ce/)

Classics and Ancient Mediterranean Studies

Graduate Program Head	Tawny Holm
Program Code	CAMS
Campus(es)	University Park
Degrees Conferred	Dual-Title
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=CAMS)

Students electing this program through participating departments will earn a degree with a dual-title at the Ph.D. level, i.e., Ph.D. in (graduate program name) and Classics and Ancient Mediterranean Studies.

The following graduate program offers a dual-title degree in Classics and Mediterranean Studies: Philosophy.

Dual-title degrees grounded both in CAMS and a given discipline will acknowledge and foster interdisciplinary scholarship. This dual-title degree program will increase the intellectual rigor, breadth, and depth of graduate work in a participating program through immersion in the disciplinary fields covered by the Department of Classics and

Ancient Mediterranean Studies: the literatures and languages of ancient Mediterranean societies; their history, social and material cultures, and their reception by other cultures.

This dual-title program will thus provide a context in which students will learn how to synthesize knowledge within and across traditional disciplinary boundaries. In addition, this dual-title degree program will provide qualified students opportunities for instructional training encouraging an interdisciplinary approach to teaching.

The primary advantages of this dual-title program include the intellectual and academic advantages and benefits of interdisciplinary study, as well as the enhancement of the reputation of the departments concerned through an innovative program, leading to recruitment of highly qualified graduate students, and an improved placement of doctoral graduates in highly-competitive humanities fields.

Admission Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Students must apply and be admitted to their primary graduate program and The Graduate School before they can apply for admission to the CAMS dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the CAMS dual-title program. Doctoral students must apply for enrollment into the dual-title degree program in CAMS prior to taking the qualifying exam in their home department.

Applicants to this dual-title degree program should have a junior/senior cumulative average of at least 3.30 (on a 4.00 scale) and appropriate academic preparation. Preference will be given to those students who have an academic record that demonstrates expertise in a field relevant to ancient Mediterranean studies and proficiency at an intermediate level (e.g., 3 semesters of study) in one or more ancient languages. Where applicable, a minimum GPA of 3.5 (on a 4.00 scale) is requisite for graduate work previously undertaken. Prospective students seeking admission to this dual-title degree program are required to write a statement of purpose that addresses the ways in which their research and professional goals will reflect an interest in interdisciplinary research in the participating program and the disciplines and fields included in CAMS.

Degree Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

To qualify for a dual-title degree, students must satisfy the requirements of the primary graduate program in which they are enrolled. In addition, they must satisfy the degree requirements for the dual-title in CAMS, listed below.

This dual-title degree will require CAMS-related course work, normally including additional course work in ancient languages, additional components to the comprehensive examinations, and the completion of a CAMS-related doctoral dissertation. A CAMS graduate supervisory committee, chaired by a CAMS faculty member closely related to the student's field of interest, will supervise the graduate study of each

student accepted into this dual-title program until all CAMS-related coursework is completed. Students will be expected to attend and participate actively in the CAMS regularly scheduled colloquia.

Course work

- 15 credits of CAMS-related coursework at the 400 or 500 level or above.
- 3 of these credits will come from CAMS 592.
- At least 3 credits will come from CAMS 593.

The remainder may come from CAMS courses or courses relevant to the student's research interests, as approved by the student's doctoral adviser and the CAMS program director of graduate studies. Unless exempted by the student's Ph.D. committee, at least 6 of these credits should be in an ancient language. No more than 6 credits can come from 400-level courses.

Qualifying Examination

Students must meet the Ph.D. qualifying exam requirements specified by the cooperating department. In addition, the student will be required to present a portfolio of work in CAMS to their committee. Such a portfolio would include a statement of the student's interdisciplinary research interests, a program plan, and samples of writing that indicate the student's work in CAMS.

The qualifying examination committee for the dual-title Ph.D. degree must include at least one Graduate Faculty member from the CAMS program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

Ph.D. committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a CAMS dual-title Ph.D. student must include at least one member of the CAMS Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in CAMS, the member of the committee representing CAMS must be appointed as co-chair. The CAMS representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

English Competency Requirements

The student will fulfill the English Competency requirements specified by the participating program.

Modern Language Reading Proficiency Requirements

Students will be expected to acquire and demonstrate reading proficiency in those modern foreign languages (e.g., but not exclusively, French, German, Italian) appropriate to their research interests, as identified in consultation with the student's Ph.D. committee.

Dissertation

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in both their primary graduate program and CAMS. Upon completion of the

doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Classics and Ancient Mediterranean Studies (CAMS) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/cams/>)

Contact

Campus	University Park
Graduate Program Head	Tawny Lee Holm
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Anna Irene Peterson
Program Contact	Kristi L Brinker klb776@psu.edu (814) 863-6433
Program Website	View (http://www.cams.psu.edu/)

Climate Science

Graduate Program Head	Raymond Najjar
Program Code	CLSCI
Campus(es)	University Park
Degrees Conferred	Dual-Title
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=CLSCI)

Students electing this degree program through participating programs earn a degree with a dual title in the Ph.D., i.e., Ph.D. in (graduate program name) and Climate Science.

The following graduate programs offer the dual-title degree in Climate Science: Anthropology, Civil Engineering, Geography, Geosciences, Meteorology and Atmospheric Science, Statistics.

The Climate Science dual-title degree program is administered by the Department of Meteorology and Atmospheric Science for the participating graduate programs. A program committee with representatives from each participating department maintains program definition, identifies courses appropriate to the program, and recommends policy and procedures for the program's operation to the dean of the Graduate School and to the deans of the participating colleges. The dual-title degree program is offered through participating programs in the College of Earth and Mineral Sciences and, where appropriate, other graduate programs in the University. The program enables students from several graduate programs to gain the perspectives, techniques, and methodologies of Climate Science, while maintaining a close association with major program areas of application. Climate Science is a field devoted to the study of Earth's climate in the past, present, and future. A particular focus is understanding the effects of human activities (anthropogenic impacts) and natural forcing on climate.

Admission Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Students must be admitted to their primary graduate program and The Graduate School before they can apply for admission to the dual-title degree program. Students must be admitted into the dual-title degree program in Climate Science no later than the end of the fourth semester (not counting summer semesters) of entry into the primary Ph.D. program.

Graduate students with research and educational interests in climate science may apply to the Climate Science Dual-Title Degree Program. Students must submit transcripts of their undergraduate and graduate course work, a written personal statement indicating the career goals they hope to serve by attaining a Climate Science dual-title, and a statement of support from their dissertation adviser. A strong preparation in the basic sciences is expected, with evidence of an interest in multiple disciplines.

Degree Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/).

To qualify for a dual-title degree, students must satisfy the requirements of the primary graduate program in which they are enrolled. In addition, they must satisfy the degree requirements for the dual-title in Climate Science, listed below.

The minimum course requirements for the dual-title in Climate Science are as follows:

Code	Title	Credits
Required Courses		
At least 3 credits of approved 400-, 500-, or 800-level courses in each of two specific areas:		6
	Climate dynamics seminar	
	Climate dynamics and observations	
3 credits of approved 400-, 500-, or 800-level courses in each of three of the four remaining areas:		9
	Physical climate system	
	Biogeochemistry of the climate system	
	Numerical methods and data analysis	
	Human dimensions of climate change	
Total Credits		15

Students are not eligible to take a 400-level course in any one of the areas if the course is offered by their primary graduate program. All students must take at least one 500-level course, and at least one course must be from outside of their core disciplinary expertise. Finally, all of the courses offered in Climate Dynamics and Observations will include sufficient material in radiative transfer and the greenhouse effect to ensure that the students clearly understand the underlying physics of climate and climate change. A list of the approved courses that will satisfy each of the area requirements is maintained by the graduate program office. Students or faculty may request that the Climate Science Committee consider approval of elective designations for any course, including temporary approvals for experimental or variable-title courses.

The qualifying examination in the primary graduate degree program satisfies the qualifying exam requirement for the dual-title degree program in Climate Science.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Climate Science dual-title doctoral degree student must include at least one member of the Climate Science Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Climate Science, the member of the committee representing Climate Science must be appointed as co-chair. The Climate Science representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in both their primary graduate program and Climate Science. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must

be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Contact

Campus	University Park
Graduate Program Head	Raymond Gabriel Najjar
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Chris E Forest
Program Contact	Karen Corl kqc8@psu.edu (814) 863-9500

Clinical and Translational Sciences

Graduate Program Head	James Pawelczyk
Program Code	CTS
Campus(es)	Hershey University Park
Degrees Conferred	Dual-Title
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=CTS)

Students electing to pursue this program through participating departments will earn a degree with a dual-title at the Ph.D. level, i.e., Ph.D. in (major program name) and Clinical and Translational Sciences.

The following graduate programs offer a dual-title degree in Clinical and Translational Sciences: Anatomy, Biobehavioral Health, Biomedical Sciences, Food Science, Human Development and Family Studies, Kinesiology, Neuroscience, Nursing, Nutritional Sciences, Pathobiology.

The College of Medicine provides academic leadership of the CTS dual-title graduate degree program. It is administered jointly on the University Park and Hershey campuses through the College of Health and Human Development and the College of Medicine, respectively, in conjunction with Penn State's Clinical and Translational Science Institute (CTSI) and in coordination with the student's primary graduate program. The CTS Education Committee maintains the program's definition and goals, identifies faculty and courses relevant to the CTS dual-title graduate program, and recommends policies and procedures for the program's operation.

The dual-title graduate degree program in CTS is designed to provide students with the aptitudes and skills necessary to expand research in their major field of study to impact clinical medicine and public health. The dual-title graduate degree program will provide opportunities to synthesize expertise across disciplinary boundaries and to evaluate the effectiveness of research to create improved clinical and/or health outcomes. This program enhances training in the major field of study by providing value-added skill sets in patient-oriented, epidemiological, behavioral, and outcomes and health services research that transition scientific findings from the laboratory to the clinical setting to best practices in the community. Clinical and translational sciences are expanding, with career paths in academic, medical and industrial settings.

Because the dual-title Ph.D. complements the primary program of study, CTS program representation must be included at all phases of graduate study, including the qualifying exam, Ph.D. committee, comprehensive exam, and final oral examination (dissertation defense).

Admission Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Students must apply and be admitted to their primary graduate program and The Graduate School before they can apply for admission to the CTS dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the CTS dual-title program. Doctoral students must be

admitted into the dual-title degree program in CTS prior to taking the qualifying examination in their primary graduate program.

An admissions committee comprised of faculty affiliated with the CTS dual-title graduate degree program will evaluate students. Applicants must have a graduate GPA of at least 3.5 in an area that relates to clinical and translational sciences. Applicants will be required to provide a statement of purpose that addresses the ways their research and professional goals will be enhanced by interdisciplinary research.

Degree Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

To qualify for a dual-title degree, students must satisfy the requirements of the primary graduate program in which they are enrolled. In addition, they must satisfy the degree requirements for the dual-title in CTS listed below.

General requirements for the dual-title Ph.D. in [major program name] and Clinical and Translational Sciences are listed below:

Code	Title	Credits
Required Courses		
CTS 590	Colloquium (two semesters)	2
Select 6 credits from the following:		6
CTS 595A	Clinical Science Internship	
CTS 595B	Translational Science Internship	
BMS 571	Graduate Clinical Rotation	
Electives		
18 additional credits from a list of approved electives in the following areas: ¹		
Statistics		3
Epidemiology		3
Bioinformatics		3
Experimental design and interpretation		3
The regulatory environment		3
Scientific communication		3
Total Credits		26

¹ The choice of CTS electives may be proposed by the student, subject to approval by the student's academic advisers from the primary and CTS programs. They should complement the student's work in the primary program. A list of approved electives (<https://sites.psu.edu/ctsprogram/current-students/elective-course-list/>) is available on the CTS program home page.

- Successful completion of qualifying and comprehensive examinations in clinical and translational sciences and the related field. The specific format and content is determined in consultation with the primary program.
- Successful defense of a dissertation in the major field with a substantial component that is clinical or translational in nature.
- Scholarship and Research Integrity (SARI) training (required of all Penn State graduate students)

- Institutional Review Board and/or Institutional Animal Care and Use Committee training (as appropriate)

Qualifying Examination

Typically, students will be accepted to the dual-title during their first year of study. In some circumstances students may be considered during the second year. To be admitted to the CTS dual-title graduate degree program students must meet the Ph.D. qualifying examination requirements in both their major area of study and the dual-title area. The qualifying exam will include both elements. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

The qualifying examination committee for the dual-title Ph.D. degree must include at least one Graduate Faculty member from the CTS program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role.

Ph.D. committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a CTS dual-title doctoral degree student must include at least one member of the CTS Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in CTS, the member of the committee representing CTS must be appointed as co-chair.

Comprehensive Exam

The CTS representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination. The comprehensive exam will require the student to demonstrate an understanding of the methods of translational sciences and an ability to apply them to problems in the student's major field of study. When appropriate, the student will be expected to demonstrate a working knowledge of methods to evaluate and compare the outcomes of his/her research to related approaches already in existence.

Dissertation

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in both their primary graduate program and CTS. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)

- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Clinical and Translational Sciences (CTS) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/cts/>)

Learning Outcomes

1. **Know:** Students will demonstrate knowledge of the core concepts of clinical and translational science, including an understanding of study design, methods, results, and significance in their major program area, integrating this comprehension/understanding in a translational context, and relating it to problems in biology, medicine, and public health.
2. **Apply/Create:** Students will be able to synthesize the research findings in their specialty area and generate ideas for a novel research project that includes one or more translational elements. They will be able to articulate the rationale for the proposed research project, clearly describe a specific hypothesis to be tested, apply best-practices in research design, test the hypothesis and complete the project successfully.
3. **Communicate:** Students will be able to convey ideas or arguments in clear, concise, well-organized papers and proposals as well as in formal, oral presentations. They will be able to discuss clinical and translational research findings with scientists from diverse disciplines, health professionals, and the lay public.
4. **Critical thinking:** Students will master the ability to critique the primary literature in their major program area and place it in a translational context. They will successfully identify research questions, experimental design and conclusions in scientific articles in the field. They will be able to recognize and summarize the strengths and weaknesses of relevant literature from multiple disciplines and to apply their knowledge of bioinformatics, epidemiology, statistics and experimental design to critique methodology and conclusions.

5. **Professional practice:** Students will demonstrate knowledge and comprehension of research integrity which are relevant to the field of clinical and translational science, including working with animals, humans, and communities; ethical principles related to authorship; plagiarism; and conflicts of interest. They will be able to work effectively in multidisciplinary teams. They will expand their understanding of the profession through internship(s) and contribute to the profession through service.

Contact

Campus	Hershey Med Ctr
Graduate Program Head	Gail D Thomas
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Jim Pawelczyk
Program Contact	Karen P Shields Clinical and Translational Science Institute 500 University Drive, P.O. Box 850, H147 Hershey PA 17033 kpb2@psu.edu
Program Website	View (http://sites.psu.edu/ctsprogram/)

Campus	University Park
Graduate Program Head	Jim Pawelczyk
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Gail D Thomas
Program Contact	Karen P Shields 15C Henderson Building University Park PA 16802 kpb2@psu.edu
Program Website	View (http://sites.psu.edu/ctsprogram/)

Clinical Psychology

Graduate Program Head	Raffy Luquis
Program Code	ACPSY
Campus(es)	Erie (M.A.) Harrisburg (M.A.)
Degrees Conferred	Master of Arts (M.A.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=ACPSY)

The Master of Arts in Clinical Psychology program helps students prepare to work as mental health professionals in a variety of settings and is intended to provide a broad training program in empirically validated clinical psychology. The program can provide the academic training necessary for graduates to apply for master's level licensing as a professional counselor in the Commonwealth of Pennsylvania and is flexible enough to prepare graduates for licensure in many other U.S. states. The M.A. program requires 60 credits of course work.

The overall model emphasizes the scientific bases of behavior, including biological, social, and individual difference factors. This scientist-practitioner training model is health-oriented rather than pathology-

oriented and emphasizes the development of helping skills, including both assessment and intervention.

The degree program is intended for both part- and full-time students. Students are admitted fall semester only. The deadline for applications is April 30.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students will be admitted on a competitive basis and must submit the following:

- completed Graduate School application form (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) with the application fee
- official transcripts from all post-secondary institutions attended (<http://gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>)
- three professional letters of recommendation, two of which need to be from academic letter writers
- a brief (two-page) interest statement

GRE scores are not required for admission, but students who do not submit GRE scores will not be eligible for most graduate assistantships and/or scholarships.

The applicant must have a bachelor's degree from a regionally accredited academic institution or the equivalent, must have completed at least 18 credits in psychology, and must have a cumulative grade-point average of 3.0 or above in the last 60 credits of undergraduate course work. The undergraduate work must include a statistics course and a psychology research methods course with grades of B or higher. Students must submit a resume or CV and an APA-style paper (from a class is appropriate) for evaluation. A personal interview is required.

Applications are processed on a rolling basis with admission to the program granted only in a fall semester

Degree Requirements

Master of Arts (M.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The M.A. in Clinical Psychology requires 60 credits of course work. At least 20 credits must be earned at the established graduate campus where the program is offered. Included in the core courses are 100 hours of clinical practicum, 600 hours of supervised internship experience, and a master's research paper completed in association with PSYC 530.

Psychology Core Courses (21 credits) provide a foundation in professional ethics, individual differences and cultural diversity, the scientific bases of behavior, and scientific research skills. These courses are intended to facilitate the development of an awareness of the context in which clients live and in which interventions must work and are grounded in research.

Clinical Core Courses (27 credits) provide a general background in clinical diagnosis, assessment, and interventions with appropriate supervised experience to allow students to develop the clinical skills appropriate for master's level practitioners.

Electives (9 credits) 400-level courses may be taken for graduate degrees and in this program may only account for nine credit hours total. The flexibility in offerings here allows students to meet licensing requirements in a variety of states.

Code	Title	Credits
Required Courses		
<i>Psychology Core Courses (21 credits)</i>		
PSYC 500	Ethics and Professional Practice in Psychology and Counseling	3
PSYC 501	Cultural Competency in Psychology	3
PSYC 502	Applied Social Psychology	3
PSYCH 424	Applied Social Psychology <small>Alternative to PSYC 502</small>	
PSYC 520	Research Methods	3
PSYC 521	Statistics	3
PSYC 524	Biological Basis of Behavior	3
PSYC 573	Career Counseling: Research, Assessment, and Intervention	3
<i>Clinical Core Courses (27 credits)</i>		
PSYC 510	Human Development and Growth	3
PSYC 517	Psychopathology	3
PSYC 518	Interviewing and Counseling	3
PSYC 519	Theories and Models of Psychotherapy	3
PSYC 540	Group Interventions	3
PSYC 571	Tests and Measurements	3
PSYC 895A	Clinical Practicum	3
PSYC 895B	Clinical Internship	6
<i>Electives (9 credits)</i>		
The list of approved elective courses is maintained by the graduate program office. The flexibility in course offerings allows students to meet licensing requirements in a variety of states.		9
<i>Culminating Experience (3 credits)</i>		
PSYC 530	Research Paper	3
Total Credits		60

Grade-Point Average

Students must have a minimum 3.00 grade-point average to graduate from the program.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)

- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

There are a limited number of scholarships and research grants available, as well as graduate assistantships.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Psychology (PSYC) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/psyc/>)

Learning Outcomes

- 1. KNOW:** Graduates will be able to demonstrate conceptual understanding and proficiency in clinical psychology and counseling from a scientist-practitioner lens and at the level required to contribute to the discipline.
- 2. THINK:** Graduates will be able to develop and use appropriate, ethical, and culturally responsive research methods and techniques to apply knowledge or create new knowledge aimed at significant questions in clinical psychology and counseling as prudent scientist-practitioners.
- 3. COMMUNICATE:** Graduates will be able to effectively communicate current research and practice applicable to the field in formal presentations and in written works.
- 4. APPLY/CREATE:** Graduates will be able to conceptualize therapeutic cases in an empirically-supported theoretical framework that is sensitive and responsive to the unique facets of each client, with emphasis of their multicultural background, developmental experiences, and environmental influences.
- 5. PROFESSIONAL PRACTICE:** Graduates will demonstrate the ability to work effectively and ethically across contemporary practice settings (e.g., schools, community-based clinics, medical settings, etc.) as competent scientist-practitioners with clients from diverse backgrounds.

Professional Licensure/Certification

Many U.S. states and territories require professional licensure/certification to be employed. If you plan to pursue employment in a licensed profession after completing this program, please visit the Professional Licensure/Certification Disclosures by State (<https://www.psu.edu/state-licensure-disclosures/>) interactive map.

Contact

Campus	Erie
Graduate Program Head	Raffy Reinaldo Luquis
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Wilson James Brown
Program Contact	Wilson James Brown School of Humanities and Social Sciences 4701 College Drive Erie PA 16563 wjb172@psu.edu (814) 898-6936
Program Website	View (http://psbehrend.psu.edu/school-of-humanities-social-sciences/academic-programs-1/master-of-applied-clinical-psychology/)
Campus	Harrisburg
Graduate Program Head	Raffy Reinaldo Luquis
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Stephanie Winkeljohn Black
Program Contact	Jeri S. Fisher Penn State Harrisburg 777 W. Harrisburg Pike Middletown PA 17057 jsf5@psu.edu (717) 948-6034
Program Website	View (https://harrisburg.psu.edu/behavioral-sciences-and-education/psychology/master-arts-applied-clinical-psychology/)
Graduate Program Head	Cheryl Thompson
Program Code	CR
Campus(es)	Hershey (M.S.)
Degrees Conferred	Master of Science (M.S.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=CR)

Clinical Research

The Master of Science program in Clinical Research includes graduate-level course work in biostatistics, epidemiology, and health services and behavioral research, and provides knowledge and insight required in health-related research. Students learn population-based methods for planning, executing, analyzing, and disseminating research results, and methods for evaluating and improving health care practices.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Prospective applicants for this program should have at least a bachelor's degree in a biological, physical, or behavioral science.

Graduate School applications must include the following items to be eligible for consideration. Incomplete applications will not be considered.

- Completed online application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>)
- Resume or CV
- Official transcripts from all colleges and universities attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>); applicants must have completed a bachelor's degree with a 3.0 GPA or higher, and must have completed at least college-level course in algebra, calculus, or statistics
- Two letters of recommendation
- GRE, GMAT, MCAT or LSAT scores - Taken within the past five years

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Each student in Clinical Research is expected to acquire breadth of knowledge in the disciplines of Biostatistics, Epidemiology, and Health Services and Behavioral Research, and skills in the areas of experimental design, data collection, and quantitative analysis. The PHS Clinical Research Master of Science degree can lead to careers in a wide variety of fields and settings, including academic health centers; the health insurance industry; health services networks; local, state, and federal government agencies; and the pharmaceutical industry.

Each student must complete at least 30 credits at the 500 or 600. Each student must submit an original Master's thesis according to the guidelines outlined by the Graduate School (<http://gradschool.psu.edu/current-students/etd/>).

Code	Title	Credits
Required Courses		
PHS 500	Research Ethics for Clinical Investigators	1
PHS 519	Patient Centered Research	3
PHS 520	Principles of Biostatistics	3
PHS 521	Applied Biostatistics	3
PHS 550	Principles of Epidemiology	3
PHS 580	Clinical Trials: Design and Analysis	3

Choose 8 credits from the following:		8
PHS 504	Behavioral Health Intervention Strategies	
PHS 518	Scientific Communication	
PHS 522	Multivariate Biostatistics	
PHS 529	Biostatistical Computing for Public Health	
PHS 530	Principles of Health Services Research	
PHS 535	Quality of Care Measurement	
PHS 536	Health Survey Research Methods	
PHS 540	Decision Analysis for Public Health	
PHS 551	Advanced Epidemiological Methods	
PHS 570	Health Economics and Economic Evaluation	
Culminating Experience		
PHS 600	Thesis Research	6
Total Credits		30

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Refer to the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students in this program are not eligible for graduate assistantships.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Public Health Sciences (PHS) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/phs/>)

Learning Outcomes

1. **KNOW** - Graduates will be able to demonstrate conceptual understanding and proficiency in the core knowledge areas of

clinical research that utilize principles/techniques in epidemiology, biostatistics and health services research.

2. **APPLY/CREATE** - Graduates will be able to search the scientific literature and synthesize available evidence in order to identify gaps to advance clinical research and areas in need of further research.
3. **THINK** - Graduates will be able to critically evaluate scientific studies in order to develop best practices for addressing specific clinical issues and/or public health challenges with a clinical focus.
4. **THINK** - Graduates will be able to design and conduct original research studies, and conduct appropriate statistical analyses to address clinical research questions and hypotheses of relevance to specific clinical and/or public health challenges.
5. **COMMUNICATE, PROFESSIONAL PRACTICE** - Graduates will learn how to work as part of a research team, to collaborate well with colleagues and to treat others with respect and consideration as part of the research process.
6. **PROFESSIONAL PRACTICE** - Graduates will conduct themselves with the highest ethical standards in terms of planning, conducting and reporting of research and protection of human and animal subjects.
7. **KNOW, APPLY/CREATE, THINK, COMMUNICATE, PROFESSIONAL PRACTICE** - Graduates will learn how to write scientific reports and journal articles and to conduct oral presentations of their research results.

Contact

Campus	Hershey Med Ctr
Graduate Program Head	Cheryl Thompson
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Li Wang
Program Contact	Shannon Tuininga smb611@psu.edu (717) 531-0003 Ext. 281150
Program Website	View (https://med.psu.edu/public-health-ms/)

Communication Arts and Sciences

Graduate Program Head	Kirt Wilson
Program Code	CAS
Campus(es)	University Park (Ph.D., M.A.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Arts (M.A.) Dual-Title Ph.D. in Communication Arts and Sciences and African American and Diaspora Studies Dual-Title Ph.D. in Communication Arts and Sciences and Bioethics Dual-Title Ph.D. in Communication Arts and Sciences and Women's, Gender, and Sexuality Studies
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=CAS)

The graduate program in Communication Arts and Sciences at the Pennsylvania State University trains students in communication science and rhetorical studies, with particular attention to political deliberation, health communication, interpersonal communication, public address, rhetorical theory, and the rhetoric of public culture. Our graduate students

conduct research investigating how communication influences attitudes and behavior, relationship development and family dynamics, public life and public memory, democratic decision making, and struggles for social justice. The most recent assessment of doctoral programs conducted by the National Communication Association ranked our program in the top five for rhetorical studies, interpersonal and small group communication.

Part of the mission of Penn State's Communication Arts and Sciences Department is "to create knowledge about the role of communication in diverse interpersonal, communal, national, international, and cultural settings." To accomplish this goal, the department welcomes graduate students and affiliated scholars who represent the widest array of identities and perspectives. We value every individual's race, gender, sexual orientation, country of origin, level of ability/disability and political perspective. We respect and seek to ensure each person's right to define their own identity and to craft the language that best represents who they are. We foster community and shared belonging, but we also recognize that positions and interests sometimes diverge. A quality graduate program, like good communication, is the result of making room for and communicating across difference.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Scores from the Graduate Record Examinations (GRE) are required for admission.

The minimum undergraduate preparation is 12 credits in communication studies/speech communication. Students who cannot meet this requirement in full may be admitted but must make up their deficiencies without credit toward the graduate degree.

Additionally, students with a 3.00 junior/senior grade-point average (on a 4.00 scale) and appropriate course backgrounds will be considered for admission. The best-qualified applicants will be accepted up to the number of spaces that are available for new students. Exceptions to the minimum 3.00 grade-point average may be made for students with special backgrounds, abilities, and interests. A student must have completed the master's degree before being admitted as a doctoral student.

Degree Requirements

Master of Arts (M.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Students pursuing the M.A. degree in Communication Arts and Sciences must take 2 credits of CAS 590 Colloquium and 3 credits of CAS 602 Supervised Experience in College Teaching; however, the 3 credits of CAS 602 cannot be counted towards the minimum 30 credits required. Students must schedule a review of their program of courses during the first year of residence and receive approval by a duly constituted advisory committee.

A minimum of 30 credits at the 400, 500, 600, or 800 level is required, with at least 18 credits at the 500 and 600 level, combined. If a student is required to write a thesis, at least 6 credits in thesis research (CAS 600

or CAS 610) must be included in the program. If no thesis is required, at least 18 credits must be in 500-level courses. Students choosing to complete a thesis must complete at least 6 credits in thesis research (CAS 600 or CAS 610). Students choosing to complete a scholarly paper must complete at least 18 credits in 500-level courses. Students must schedule a proposal meeting in which their research plan for their thesis is approved by their committee. They are also required to present an oral defense before their committee. The thesis must be accepted by the committee members, the head of the graduate program, and the Graduate School, and the student must pass the thesis defense.

Although typically discouraged, students in unique circumstances may apply to complete a non-thesis track. Students must apply in advance for acceptance in the non-thesis track and additional course credits will be required, among other differences from the thesis track. The specific requirements for the non-thesis track will be established based on the student's application and subject to approval by the M.A. committee. The non-thesis track requires completion of a scholarly paper in place of the thesis.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Students must take 2 credits of CAS 590 Colloquium and 3 credits of CAS 602 Supervised Experience in College Teaching. Doctoral students must schedule and pass a qualifying examination during their first year. Following completion of the English competence requirement and all courses from the program of study, doctoral students must pass a comprehensive examination to determine their mastery and competence in the discipline of communication. After successful completion of the written and oral component of the comprehensive exam, doctoral candidates must schedule a proposal meeting at which the research plan for their dissertation is approved by their Ph.D. committee. Doctoral candidates must pass a final oral defense of their dissertation before their Ph.D. committee. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Titles

Dual-Title Ph.D. in Communication Arts and Sciences and African American and Diaspora Studies

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Dual-title CAS and AFAM graduate students will first be admitted to CAS in accordance with the requirements stipulated by Graduate Council and the department. After admission to the CAS Ph.D. program, students must apply for admission to and meet the admissions requirements of the African American and Diaspora Studies dual title program. Refer to the Admission Requirements section of the African American and Diaspora Studies Bulletin (<https://bulletins.psu.edu/graduate/programs/majors/african-american-diaspora-studies/>) page. Doctoral students must be admitted into the dual-title degree program in African American and Diaspora Studies prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for a dual-title degree, students must satisfy the requirements of the CAS Ph.D. program in which they are primarily enrolled. In addition, students must complete the degree requirements for the dual-title Ph.D. in African American and Diaspora Studies, listed on the AFAMD DualTitle Bulletin Page (<https://bulletins.psu.edu/graduate/programs/majors/african-american-diaspora-studies/>). No more than 6 credits may be double counted towards both CAS Ph.D. and AFAMD dual-title degree requirements. Within this framework, final course selection is determined by the student, their CAS and AFAMD advisers.

Qualifying Examination

Students must meet the Ph.D. qualifying examination requirements specified by the CAS program. During the qualifying examination, the student will also be assessed for qualifying to the dual-title program, and at least one member of the qualifying examination committee must come from the AFAMD dual-title program. Faculty members who hold appointments in both programs may serve in a combined role. Students in the dual-title Ph.D. program will be required to present to their committee a portfolio of work in African American and Diaspora Studies that includes a statement of the student's interdisciplinary research interests, a program plan, and samples of writing that indicate the student's interest in questions taken up by scholars of African American and Diaspora Studies. There will be a single qualifying examination, containing elements of both CAS and AFAMD. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

Ph.D. Committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>), at least two members of the committee must be members of the African American and Diaspora Studies graduate faculty. If the chair is not a member of the AFAMD Graduate Faculty, the committee member representing AFAMD must be appointed co-chair of the committee. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role.

Comprehensive Examination

The African American and Diaspora Studies representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination. The faculty member (or members) affiliated with the dual-title Ph.D. program will be responsible for administering a portion of the comprehensive exam that will require the student to demonstrate an understanding of various theoretical and methodological approaches to African American Studies, and an ability to apply them to issues and problems in the field.

Dissertation and Final Oral Examination

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in CAS and AFAMD. The African American and Diaspora Studies-related topic of the dissertation or the African American and Diaspora Studies component will be approved by the student's Ph.D. committee. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title Ph.D. in Communication Arts and Sciences and Bioethics

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Dual-title bioethics graduate students will first be admitted to their primary program in accordance with the requirements stipulated by Graduate Council and the primary program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Bioethics dual-title program. Refer to the Admission Requirement section of the Bioethics Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/bioethics/>). They will be admitted to graduate study in the Bioethics program by an admissions committee consisting of faculty affiliated with the Bioethics program. Doctoral students must be admitted into the dual-title degree program in Bioethics prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for a dual-title degree, students must satisfy the requirements of the CAS Ph.D. degree program in which they are primarily enrolled. In addition, students must complete the degree requirements for the dual-title Ph.D. in Bioethics, listed on the Bioethics Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/bioethics/>). Within this framework, final course selection is determined by the student, their CAS and Bioethics advisers.

Qualifying Examination

Students must meet the Ph.D. qualifying examination requirements specified by the CAS program. During the qualifying examination, the student will also be assessed for the Bioethics program, and at least one member of the qualifying examination committee must come from the Bioethics program. Faculty members who hold appointments in both programs may serve in a combined role. There will be a single qualifying examination, containing elements of both CAS and bioethics. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

Ph.D. Committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a CAS and Bioethics dual-title Ph.D. student must include at least one member of the Bioethics Graduate Faculty. Graduate students are encouraged to have a second committee member so qualified. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Bioethics, the member of the committee representing Bioethics must be appointed as co-chair. The Bioethics representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Comprehensive Examination

The faculty member (or members) affiliated with the Bioethics Program will be responsible for administering a portion of the comprehensive exam that will require the student to demonstrate an understanding of various theoretical and methodological approaches to bioethics,

and an ability to apply them to issues and problems (including, where appropriate, practical problems) in their primary field.

Dissertation and Final Oral Examination

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in CAS and Bioethics. The bioethics-related topic of the dissertation or the bioethics component will be approved by the student's Ph.D. committee. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title Ph.D. in Communication Arts and Sciences and Women's, Gender, and Sexuality Studies

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Dual-title CAS and WGSS graduate students will first be admitted to CAS in accordance with the requirements stipulated by Graduate Council and the department. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the WGSS dual-title program. Refer to the Admission Requirements section of the WGSS Bulletin (<https://bulletins.psu.edu/graduate/programs/majors/womens-gender-sexuality-studies/>) page. They will be admitted to graduate study in the dual-title program by a committee consisting of faculty from WGSS. Doctoral students must be admitted into the dual-title degree program in Women's Gender, and Sexuality Studies prior to taking the qualifying examination in the primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the Ph.D. degree in CAS. In addition, students must complete the degree requirements for the dual-title in WGSS, listed on the WGSS Bulletin (<https://bulletins.psu.edu/graduate/programs/majors/womens-gender-sexuality-studies/>) page. No more than 6 credits may be double counted towards both the CAS Ph.D. and the WGSS dual-title degree requirements. Within this framework, final course selection is determined by the student and the CAS and WGSS advisers.

Qualifying Examination

Students must meet the Ph.D. qualifying examination requirements specified by the CAS program. During the qualifying examination, the student will also be assessed for qualifying to the dual-title program, and at least one member of the qualifying examination committee must come from the WGSS dual-title program. Faculty members who hold appointments in both programs may serve in a combined role. Students in the dual-title Ph.D. program will be required to present to their committee a portfolio of work in Women's, Gender, and Sexuality Studies that includes a statement of the student's interdisciplinary research interests, a program plan, and samples of writing that indicate the student's interest in questions taken up by scholars of Women's, Gender, and Sexuality Studies. There will be a single qualifying examination, containing elements of both CAS and WGSS. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

Ph.D. Committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>), at least two members of the Ph.D. committee must also be Women's, Gender, and Sexuality Studies-affiliated faculty. If the chair is not a member of the WGSS graduate faculty member, the committee member representing WGSS must be appointed co-chair of the committee. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role.

Comprehensive Examination

The WGSS representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination. The faculty member (or members) affiliated with the dual-title Ph.D. program will be responsible for administering a portion of the comprehensive exam that will require the student to demonstrate an understanding of various theoretical and methodological approaches to Women's, Gender, and Sexuality Studies, and an ability to apply them to issues and problems in the field.

Dissertation and Final Oral Examination

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in CAS and WGSS. The Women's, Gender, and Sexuality Studies-related topic of the dissertation or the WGSS component will be approved by the student's Ph.D. committee. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/>)

gsad/gsad-900/gsad-901-graduate-assistants/) set by The Graduate School.

In addition to the fellowships, traineeships, graduate assistantships, and other forms of financial aid described on The Graduate School's website (<http://gradschool.psu.edu/graduate-funding/>), the following awards typically have been available to graduate students in this program:

Edwin Erle Sparks Fellowships in the Humanities
Available to beginning and continuing graduate students in one of the following graduate programs:

- Communication Arts and Sciences
- Comparative Literature
- English
- French
- German
- History
- Linguistics
- Philosophy
- Spanish

Apply to department before February 1.

Additional funding opportunities may be available for graduate students enrolled in a dual-title program in which Communication Arts & Sciences participates. Please speak to the Graduate Officer and Director for further information about these opportunities.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Communication Arts and Sciences (CAS) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/cas/>)

Learning outcomes

1. Graduates will demonstrate command of the history of and current developments in rhetorical or communication science theory and methods.
2. Graduates will demonstrate the capacity to organize, synthesize, and critique the theoretical and methodological literature relevant to their area of disciplinary specialization.
3. Graduates will formulate and execute an independent research project that significantly furthers knowledge and theory in rhetoric or communication science.
4. Graduates will articulate ideas, arguments, and evidence with clarity, creativity, and compatibility with the conventions of the discipline in oral and visual presentations and written formats.
5. Graduates will develop professional practices through department service, conference participation, and disciplinary engagement.
6. Graduates will display capacity to deliver effective undergraduate and graduate instruction, including course design and delivery.

Contact

Campus	University Park
Graduate Program Head	Kirt H Wilson
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Andrew High
Program Contact	Alexandria Nichols 234 Sparks Building University Park PA 16802 apn5571@psu.edu (814) 865-5558
Program Website	View (http://cas.la.psu.edu/)

Communication Sciences and Disorders

Graduate Program Head	Diane L. Williams
Program Code	CSD
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Dual-Title Ph.D. in Communication Sciences and Disorders and Language Science Dual-Title Ph.D. in Communication Sciences and Disorders and Social and Behavioral Neuroscience
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=CSD)

The goals of the program in Communication Sciences and Disorders are to train professionals to conduct research and be consumers of research in communication sciences and disorders and to prepare competent professionals to habilitate and rehabilitate individuals who have speech, language, and/or hearing problems. The program also serves to provide students in other curricula at Penn State with orientation toward and information about communication sciences and disorders.

Facilities for student training and research include in-house clinical therapy and diagnostic services, laboratories in speech science and audiology, and affiliated schools and clinics. The program enjoys academic, research, and clinical relationships with a number of related programs at Penn State and draws upon academic work from related areas as part of the graduate training in communication sciences and disorders. Preparation is given for school and professional certifications and licensure. The CSD M.S. program is accredited by the Council of Academic Affairs of the American Speech-Language-Hearing Association. Master's-level graduate study requires a full-time externship experience, ordinarily occurring during the final semester of study.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Master of Science (M.S.)

Minimum requirements for admission to the master's program include:

- Cumulative GPA, GPA in the major, and/or last 60 credits GPA greater than 3.0
- Excellent letters of recommendation
- A strong, well-written personal statement
- Demonstrated proficiency of the English language as required by the Graduate Council
- The completion of several undergraduate courses
- 25 clinical observation hours

Scores from the Graduate Record Examination (GRE) may be submitted but are not required.

Prerequisite courses are required for admission.

Required coursework includes:

- Anatomy and Physiology of Speech and Hearing Mechanisms (3 credits)
- Introduction to Audiology (3 credits)
- Aural Rehabilitation (Auditory Training, Speech Reading, etc.) (3 credits)
- Clinical Phonetics (3 credits)
- Normal Language Development (3 credits)
- Acoustic Principles in Communication Sciences and Disorders (3 credits)
- Introduction to Disorders of Articulation and Phonology (3 credits)
- Principles of Clinical Management in Communication Sciences and Disorders (3 credits)
- Statistics (3 credits)
- 3 credits in biological sciences
- 3 credits in physical sciences
- 6 credits in behavioral and/or social science

Students provisionally admitted (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-303-provisional-admission/>) who have not completed these courses will be required to take additional make-up work. Additional make-up work may extend the program.

Doctor of Philosophy (Ph.D.)

Usually, students earn a master's degree in communication sciences and disorders prior to being considered for doctoral study, although persons with master's degrees in other fields will be considered for a doctoral program.

Minimum requirements for admission to the doctoral program include:

- A cumulative GPA in their Master's program of well above a 3.0 on a 4.0 scale
- Outstanding letters of recommendation documenting their performance and their potential as researchers and scholars
- A written statement of scholarly interests and research career goals, as described on the department's webpage
- Completed the Graduate Record Examination (GRE)
 - GRE scores are optional; the inclusion or the non-inclusion of GRE scores will not alter applicants' chance of acceptance into the program. Applicants are encouraged to submit GRE scores to provide evidence of their technical and/or writing skills in the

absence of other supporting evidence. It is recommended that applicants have GRE scores greater than the fiftieth percentile on the verbal and quantitative sections and a 4.5 or above on the writing section.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The master's program of study provides course work and practicum for advanced and/ or professional-level licensure.

The master's program of study provides course work and practicum for advanced and/ or professional-level licensure.

The master's degree requires a minimum of 50 credits at the 400, 500, 600, or 800 level (with at least 18 credits at the 500 and 600 level, combined) beyond admission standards. Students usually earn 55 to 65 credits to complete a degree, over four semesters and a summer of study.

Code	Title	Credits
Required Courses		
CSD 500	Research Methods in Communication Sciences and Disorders	3
CSD 520	Physiologic and Acoustic Issues in Speech Science	3
CSD 540	Phonological Disabilities	3
CSD 541	Voice Production, Differences, and Disorders	3
CSD 542	Stuttering	3
CSD 543	Cleft Palate and Resonance Disorders	1
CSD 545	Neuromotor Disorders of Speech	3
CSD 546	Language Disorders in Adults	3
CSD 547	Language Disorders in Children	3
CSD 548	Dysphagia	3
CSD 549	Speech-Language Pathologists in the Schools ¹	3
CSD 551	Assessment and Intervention in Augmentative and Alternative Communication	3
CSD 596	Individual Studies	2
CSD 895A	Speech Therapy Practicum	1-3
CSD 895C	Speech/Language Therapy Externship	7-15
CSD 895G	Speech Diagnostics Practicum	1-3
CSD 895I	Speech Pathology Mini-Placement	1-9
<i>Culminating Experience</i>		
CSD 600 or CSD 596	Thesis Research Individual Studies	2-6

¹ CSD 549 is only required for students who plan on obtaining teacher certification.

Students can choose to complete a thesis or a scholarly paper as the culminating experience for the degree. The non-thesis option for the Master of Science degree requires a scholarly paper and additional course credits in lieu of a thesis. Students choosing to complete a thesis must complete at least 6 credits in thesis research (600 or 610). Students

choosing to complete a scholarly paper must complete at least 18 credits in 500-level courses.

The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School, and the student must pass a thesis defense. The scholarly paper must be accepted by the student's adviser and the head of the graduate program.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The Doctor of Philosophy degree normally requires a master's degree in communication sciences and disorders or a related field, plus a minimum of two years of advanced study, and presentation and oral defense of a research-based dissertation.

The Doctor of Philosophy degree normally requires a master's degree in communication sciences and disorders or a related field, plus a minimum of two years of advanced study, and presentation and oral defense of a research-based dissertation (the final oral examination). The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

There are no core or required courses for the Ph.D. degree.

Two research exercises, one of which is used for doctoral qualifying examination early in the doctoral program, are required prior to the dissertation. A comprehensive written and oral examination in the areas of a student's interest is required.

Details of a student's doctoral program are determined by the Ph.D. committee.

Dual-Titles

Dual-Title Ph.D. in Communication Sciences and Disorders and Language Science

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Graduate students with research and educational interests in language science may apply to the Communication Sciences and Disorders and Language Science Degree Program. The goal of the dual-title degree in Communication Sciences and Disorders and Language Science is to enable graduate students from Communication Sciences and Disorders to acquire the knowledge and skills of their major area of specialization in Communication Sciences and Disorders, while at the same time gaining the perspective of the various disciplines contributing to the study of language science.

Admission Requirements

For admission to the dual-title degree under this program, a student must first apply and be admitted to the Communication Sciences and Disorders graduate program and the Graduate School. New graduate students in Communication Sciences and Disorders will receive information about the Language Science dual-title program, and may discuss their interest with one or more Language Science faculty in the Department of Communication Sciences and Disorders, in order to obtain a recommendation for admission to the Language Science program. Once accepted into the Communication Sciences and Disorders program,

and with a recommendation from a Language Science program faculty member in that department, the student may apply to the dual-title Ph.D. program in Communication Sciences and Disorders and Language Science by submitting a letter describing the student's interest in the program. Refer to the Admission Requirements section of the Language Science Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/language-science/>). Doctoral students must be admitted into the dual-title degree program in Language Science prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for a dual-title degree, students must satisfy the requirements of the Communication Sciences and Disorders program in which they are primarily enrolled. In addition, students must complete the degree requirements for the dual-title Ph.D. in Language Science, listed on the Language Science Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/language-science/>). Within this framework, final course selection is determined by the student and their Communication Sciences and Disorders program adviser.

Particular courses may satisfy both the Communication Sciences and Disorders requirements and those in the Language Science dual-title program. Final course selection is determined by the student in consultation with their doctoral adviser and Ph.D. committee. In most cases, the number of total credits earned by a dual-title student will be from 6-12 more than those normally earned by a student in Communication Sciences and Disorders. Some courses which meet Language Science requirements (e.g., theoretical linguistics, neuroscience, psycholinguistics) may also fulfill the Communication Sciences and Disorders requirements for a related area outside the department; however, dual-title students are not required to count any particular Language Science requirement as their outside area. Dual-title students who choose an outside content area not related to Language Science will require more time to complete their program.

Students are expected to participate in weekly Language Science Research meetings each semester in residence.

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Communication Sciences and Disorders and must include at least one Graduate Faculty member from the Language Science program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Communication Sciences and Disorders and Language Science. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Communication Sciences and Disorders and Language Science dual-title Ph.D. student must include at least one member of the Language Science Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Language Science, the member of the committee representing Language Science must be appointed as co-chair. The Language Science representative on the student's Ph.D.

committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Communication Sciences and Disorders and Language Science. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title Ph.D. in Communication Sciences and Disorders and Social and Behavioral Neuroscience

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Graduate students with research and educational interests in neuroscience may apply to the Communication Sciences and Disorders and Social and Behavioral Neuroscience Degree Program. The goal of the dual-title degree in Communication Sciences and Disorders and Social and Behavioral Neuroscience is to enable graduate students from Communication Sciences and Disorders to acquire interdisciplinary training that will enable them to apply the techniques and perspectives of neuroscience to the study of communication sciences and disorders.

Admission Requirements

Before they can apply for admission to the dual-title degree program, students must apply and be admitted to the Ph.D. program in Communication Sciences and Disorders and the Graduate School. Applicants who are interested in the dual-title degree program will have the opportunity to indicate this interest when applying to the program in Communication Sciences and Disorders and may discuss their interest with one or more Social and Behavioral Neuroscience faculty in the Department of Communication Sciences and Disorders. In their statements of purpose for admission, applicants may also comment on how their interests in Communication Sciences and Disorders are related to their interests in Social and Behavioral Neuroscience.

Students may apply for enrollment in the dual-title degree program in Social and Behavioral Neuroscience during their first year (second semester) or second year in Communication Sciences and Disorders. Refer to the Admission Requirements section of the Social and Behavioral Neuroscience Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/social-behavioral-neuroscience/#admissionrequirements>). Students must be admitted into the dual-title degree program in Social and Behavioral Neuroscience prior to taking the qualifying examination in Communication Sciences and Disorders.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements of the Ph.D. program in Communication Sciences and Disorders. In addition, students must complete the degree requirements for the dual-title in Social and Behavioral Neuroscience, listed on the Social and Behavioral Neuroscience Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/social-behavioral-neuroscience/#degreerequirementstext>).

Particular courses may satisfy both the Communication Sciences and Disorders requirements and those in the Social and Behavioral Neuroscience dual-title program. Final course selection is determined

by the student in consultation with their doctoral adviser and Ph.D. committee. In most cases, the number of total credits earned by a dual-title student will be from 6-9 more than those normally earned by a student in Communication Sciences and Disorders.

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Communication Sciences and Disorders and must include at least one Graduate Faculty member from the Social and Behavioral Neuroscience program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Communication Sciences and Disorders and Social and Behavioral Neuroscience. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>), the Ph.D. committee of a Communication Sciences and Disorders and Social and Behavioral Neuroscience dual-title Ph.D. student must include at least one member of the Social and Behavioral Neuroscience Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Social and Behavioral Neuroscience, the member of the committee representing Social and Behavioral Neuroscience must be appointed as co-chair. The Social and Behavioral Neuroscience representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Dissertation and Dissertation Defense

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Communication Sciences and Disorders and Social and Behavioral Neuroscience. The dissertation must involve the integration of neuroscience and a research question of interest within Communication Sciences and Disorders. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the heads of both graduate programs, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)

- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Communication Sciences and Disorders (CSD) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/csd/>)

Learning Outcomes

Master of science (M.S.)

1. **KNOW:** Graduates will be able to demonstrate deep conceptual understanding and proficiency in theories related to the field of communication sciences and disorders.
2. **KNOW:** Graduates will be able to demonstrate applied clinical principles and practices required to provide competent clinical services.
3. **THINK:** Graduates will be able to critically conceptualize and define the critical aspects of a clinical case and determine and apply practical and theoretically driven solutions.
4. **APPLY/CREATE:** Graduates will demonstrate proficiency in assessing, designing, and executing a research strategy to answer significant questions that have real world applications in the field of communication sciences and disorders.
5. **COMMUNICATE:** Graduates will be able to effectively communicate relevant theory, evidence-based practice, and decision-making during group presentations of clinical cases and client outcomes.
6. **COMMUNICATE:** Graduates will be able to effectively communicate research and clinical evidence in presentations at local, national, and/or international meetings or conferences.
7. **PROFESSIONAL PRACTICE:** Graduates will demonstrate an understanding of and commitment to clinical ethics, collaboration, as well as federal guidelines for service provision and client protection (e.g., IDEA, HIPAA).

Doctor of Philosophy (Ph.D.)

1. **KNOW, APPLY/CREATE:** Graduates will demonstrate command of the history and current developments in theory and methods relevant to their specific area of study within the field of communication sciences and disorders.

2. **KNOW:** Graduates will master the current literature relevant to their specific area of study within the field of communication sciences and disorders.
3. **APPLY/CREATE, COMMUNICATE:** Graduates will formulate and execute at least two independent research projects that significantly contribute to the knowledge base and theory in their specific area of study within the field of communication sciences and disorders.
4. **COMMUNICATE:** Graduates will articulate arguments and ideas with clarity in oral presentations and written formats and use the conventions of the discipline specific area of study within the field of communication sciences and disorders.
5. **PROFESSIONAL PRACTICE:** Graduates will demonstrate knowledge of the professional standards of scholarly and professional work in their specific area of study within the field of communication sciences and disorders through their written and oral works, and interactions with colleagues.

Professional Licensure/Certification

Many U.S. states and territories require professional licensure/certification to be employed. If you plan to pursue employment in a licensed profession after completing this program, please visit the Professional Licensure/Certification Disclosures by State (<https://www.psu.edu/state-licensure-disclosures/>) interactive map.

Contact

Campus	University Park
Graduate Program Head	Diane L Williams
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Nicole Etter (she/her)
Program Contact	Robin L Bang 308 Ford Building University Park PA 16802 rib10@psu.edu (814) 865-0971
Program Website	View (https://hhd.psu.edu/csd/)

Communications

Graduate Program Head	Jeffrey Beck
Program Code	COMMS
Campus(es)	Harrisburg (M.A.)
Degrees Conferred	Master of Arts (M.A.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=COMMS)

The Master of Arts in Communications prepares students for doctoral study and leadership positions in areas of public information such as journalism, education, public relations and advertising. The program places an emphasis on cultivating an interdisciplinary and intercultural perspective for media educators and practitioners who may serve publics in a variety of fields, including business, government agencies, non-profit organizations, and community and political action groups. Because our program is broad-based and research-oriented, students will work with their academic advisers to develop their thesis projects to address critical

issues in the above areas, rather than acquiring a specific and narrowly defined skill set.

The program balances research and creative production by integrating national and international perspectives on history, culture, and society in all instruction in theory and production practice.

Because of the program's location in the Pennsylvania state capital region and its close proximity to prominent public and private institutions and other resources, students in the program will have opportunities for internships and field experiences that provide valuable context for the development of their thesis projects. This integrated approach between theory and practice positions the program to provide a strong foundation for the pursuit of doctoral studies in communications.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Applicants must hold either (1) a bachelor's degree from a U.S. regionally accredited institution or (2) a postsecondary degree that is equivalent to a U.S. baccalaureate degree earned from an officially recognized degree-granting international institution and have earned at least a 3.0 grade-point average in their junior and senior years.

Exceptions may be made for those with special backgrounds or abilities who are committed to advanced interdisciplinary study in communications. All application materials should be submitted before February 15 for the fall semester and November 1 for the spring semester.

Applicants must submit the following:

- an online Graduate School application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) with the application fee;
- official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>) (with the exception of Penn State University).
- a personal statement of 500 to 1000 words outlining educational goals and career objectives;
- two letters of reference attesting to the applicant's suitability for the program (preferably from previous professors or others who are familiar with the applicant's intellectual/creative work or interests);
- a writing sample or other creative production (e.g. short film, photo essay, advertisement or PR campaign sample, multimedia art, etc).

International applicants must hold the equivalent of an American four-year baccalaureate degree. They must submit official or attested university records, with certified translations if the records are not in English. Notarized copies are not sufficient.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of Arts (M.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Students admitted to the Master of Arts in Communications Program at Penn State Harrisburg must complete 36 credits, 21 of which must be at the 500 level in order to be granted the degree. Each student must complete and submit either a master's project or thesis. The master's project option (COMMS 580) consists of a creative production with an accompanying scholarly essay. The thesis option (COMMS 600 or COMMS 610) consists of an original research paper that follows the guidelines established by the Graduate School's Office of Theses and Dissertations (<http://gradschool.psu.edu/current-students/etd/>). The subject of the master's project or thesis must be defined in conjunction with a faculty member, and evaluated by a committee of at least two faculty members, supplemented by outside consultants where appropriate. To register for the master's thesis or project, a student must have completed COMMS 500 and COMMS 503 and must have earned at least 27 credits towards the Master of Arts in Communications.

The 36-credit program is distributed over two groups of courses:

Code	Title	Credits
Required Courses		
Take a minimum 9-12 credits of the following:		9-12
COMMS 500	Communications and Cultural Theory ¹	
COMMS 503	Research Methods in Communications ¹	
COMMS 580	Communications Master's Project ²	
COMMS 600	Thesis Research ²	
or COMMS 6 Thesis Research		
Choose 6 credits from ONE of the following:		6
COMMS 525	Advanced Writer's Seminar	
or COMMS 5 Media Production Workshop		
Choose 6 credits of the following:		6
COMMS 519	Communication Technology and Culture in History	
COMMS 555	Media Discourse Analysis	
COMMS 560	Seminar on Global Culture and Communication	
Electives		
Take 15 credits in additional courses at the 400- and 500-levels, from a list of approved courses maintained by the graduate program office. Elective courses can come from either Communications or other fields, including: American Studies, Business Administration, Community Psychology and Social Change, Criminal Justice, Education, Health Administration, Health Education, Humanities, Information Systems, Management, Marketing, Public Administration, Training and Development. ³		15
Total Credits		36-39

¹ COMMS 500 and COMMS 503 to be taken within the first 12 credits after enrollment in the program.

² Students elect EITHER COMMS 580 or COMMS 600/COMMS 610. If a student chooses to write a thesis, at least 6 credits in thesis research (COMMS 600 or COMMS 610) must be included in the program.

³ The following 400-level Communications courses may not be taken to fulfill the requirements of this degree:

- COMM 495
- COMM 495A
- COMM 496
- COMM 497

Grade-Point Average and Time Limit

A 3.00 grade-point average will be required for successful completion of the degree.

A full-time student can expect to complete the program in four semesters, a part-time student in six or more semesters. All requirements for a master's degree for the Master of Arts in Communications (including acceptance of the master's thesis or project) must be met within eight years of admission to degree status. Extensions may be granted by the Graduate School in appropriate circumstances.

Transfer of Credits

Transfer credits are limited to 9 equivalent graduate Communications credits with a grade of B or better taken within the last 5 years from an accredited institution, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>). It must be the opinion of the reviewing faculty that these courses are equivalent in quality to those offered at Penn State Harrisburg. Credit will not be given for any course used to complete a previous degree.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Communications (COMMS) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/comms/>)

Learning Outcomes

1. **KNOW:** Graduates demonstrate knowledge and proficiency in the major theories and methods used in the study of Communications and their applications in intellectual inquiry and creative activity.
2. **APPLY/CREATE:** Graduates design and execute strategies to answer significant questions in Communications and produce or create highest quality media content – such as films, videos, photography, graphic design, Web-based platforms, screenwriting, journalism, memoirs, drama, copywriting and social media. – according to the highest professional and ethical standards.
3. **COMMUNICATE:** Graduates convey ideas or arguments in clear, concise, well-organized written proposals, research papers, exhibitions and oral presentations in professional and academic settings, and communicate to diverse audiences by audio, visual and written media such as video, film, journalism, graphic design, photography, copywriting and social media.
4. **CRITICAL THINKING:** Graduates utilize analytical skills to evaluate ideas, theories and academic and cultural works in the Communications field, and to conceptualize solutions to communications problems and challenges in different social/cultural contexts.
5. **PROFESSIONAL PRACTICE:** Graduates observe the highest ethical standards in both scholarship and professional practice.

Contact

Campus	Harrisburg
Graduate Program Head	Jeffrey P Beck
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Yonatan Tewelde
Program Contact	Amber Reichwein W-356 777 W. Harrisburg Pike Middletown PA 170574898 anr244@psu.edu (717) 948-6201
Program Website	View (https://harrisburg.psu.edu/humanities/communications/master-arts-communications/)

Community and Economic Development

Graduate Program Head	Laszlo Kulcsar
Program Code	CEDEV
Campus(es)	World Campus
Degrees Conferred	Master of Professional Studies (M.P.S.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=CEDEV)

The Master of Professional Studies in Community and Economic Development (M.P.S. CEDEV) is a 30-credit terminal master's degree program that emphasizes an interdisciplinary approach to community and economic development. The program balances theory and practice. Courses are taught in M.P.S. CEDEV use a blend of web technology, print, and other media to provide an effective balance of flexibility and interaction. Individuals who currently work with, or are interested in working with communities, community organizations and stakeholders, or on a range of community and economic development issues at the state or national levels would benefit from this program.

Instruction in the MPS CEDEV program emphasizes key themes that include:

- economic planning and development,
- municipal finance, land use and population change,
- community structure, organization and process,
- leadership,
- tools and techniques in community development, and
- community decision-making and capacity building

Students in Community and Economic Development gain a broad understanding of the dynamics of communities and their social, economic, and political systems. The program emphasizes teaching the theory, skills, and tools that allow practitioners to address the important issues in development practice.

Graduates of the Community and Economic Development program have a wide range of career opportunities, including:

- local and state government,
- planning commissions,
- major corporations,
- non-governmental organizations, and
- consulting firms.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students with a 3.00 average (on a 4.00 scale) for the most recent two years of college/university education, or with an advanced degree, and with appropriate course and experiential backgrounds will be considered for admission. Exceptions to the minimum 3.00 grade-point average may

be made for students with special backgrounds, experience, abilities, and interests, at the discretion of the program. The best-qualified applicants will be accepted to the graduate program.

Admission requirements include the following:

- Statement of purpose describing professional experiences and education, career goals, and how the M.P.S. program will enable the applicant to meet their objectives
- Current resume
- Three letters of recommendation
- Official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>)
- Non-refundable application fee

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Scores from the Graduate Record Examinations (GRE) are not required for admission to the M.P.S. CEDEV program.

Prerequisites for the master's program include 12 credits in rural sociology, sociology, agricultural economics, or other social and behavioral sciences at the discretion of the graduate program. If the entering student does not have these prerequisites, they must be made up at the University during the early part of the master's program. Credits obtained to fulfill entry and pre-program requirements cannot be applied towards requirements for the degree.

Degree Requirements

Master of Professional Studies (M.P.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The MPS CEDEV program requires the completion of seven core courses (21 credits) in which students learn and apply sociological and economic concepts to issues in community and economic development. The courses offer examples and opportunities to apply these concepts to real issues facing communities and rural regions. Two of the core courses (6 credits) emphasize statistical methods and tools and techniques useful to practitioners in community and economic development, or to work toward additional certifications. All students are required to satisfy one of two requirements: (1) completion of a Master's paper (at least 3 credits) that integrates theory and practice, or (2) completion of a series of Comprehensive Exam essays on questions from each of the required courses.

The M.P.S. degree requires a minimum of 30 credits at the 400, 500, or 800 level, with a minimum of 18 credits at the 500 or 800 level, and at least 6 credits at the 500 level. All students complete the required M.P.S. CEDEV core program of 15 credits of community and economic development courses, statistics, and methods.

Code	Title	Credits
Required Courses		
CEDEV 430	Principles of Local Economic Development	3
CEDEV 452	Community Structure, Processes and Capacity	3
CEDEV 500	Community and Economic Development: Theory and Practice	3
CEDEV 505	Leadership Development	3
CEDEV 509	Population, Land Use, and Municipal Finance	3
STAT 500	Applied Statistics (or equivalent)	3
CEDEV 575	Methods and Techniques for Community and Economic Development	3
CEDEV 580	Community and Economic Development Research Application and Practice	3
Electives ¹		3
Culminating Experience		
CEDEV 596	Individual Studies ²	3
Total Credits		30

¹ Choice of electives will be based on a plan of study worked out between the student and faculty adviser.

² A Master's paper is required where the student demonstrates the capability to integrate and apply concepts, principles, analytical techniques, and interpretation skills learned in the program to a real problem faced by a community or community organization. The Master's paper is completed while the student is enrolled in CEDEV 596. In place of the Master's Paper, students may choose to complete a series of Comprehensive Exam essays on questions relevant to each required course. Students choosing to complete the Comprehensive Exam also enroll in CEDEV 596.

There is no foreign language requirement for the degree; however, students planning to work in multi-cultural or international settings are encouraged to gain competency in an appropriate language(s).

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Community and Economic Development (CEDEV) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/cedev/>)

Learning Outcomes

1. **KNOW:** Graduates will demonstrate an understanding of basic economic and sociological theory, data collection and analytical techniques, and research methodologies at a level sufficient to work to solve problems and issues in their region or local community. They will also demonstrate an understanding of the systems and processes that define a region and community.
2. **APPLY/CREATE:** Graduates will be able to develop a research methodology and study in detail a problem or issue experienced by their region or local community. They will be able to make recommendations for specific programs and policies to address both economic and social issues and in an effort to improve the quality of life in their region or community.
3. **COMMUNICATE:** Graduates will be able to effectively convey to others the basic theories and research in community and economic development and related fields through oral and written communications.
4. **THINK:** Graduates will be able to review and critically analyze studies and work from multiple disciplines and apply this work to problems and issues in their region or local community. They will be able to differentiate between economic and social systems within their regions and communities.
5. **PROF. PRACTICE:** Nearly all of our students already have jobs in a profession directly related to community and economic development. Our graduates will demonstrate that they have developed sufficient skills to continue to contribute to their profession. They will be able to interact productively in an ethical manner with other professionals and community leaders and demonstrate a commitment to active citizenship within their community.

Contact

Campus	World Campus
Graduate Program Head	Laszlo Kulcsar
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Mary Kate Berardi
Program Contact	Julie Lynn Stringfellow 305 Armsby Building University Park PA 16802 jls1007@psu.edu (814) 865-6223
Program Website	View (http://aese.psu.edu/graduateprograms/cedev/)

Comparative and International Education

Graduate Program Head	Kevin Kinser
Program Code	CIED
Campus(es)	University Park
Degrees Conferred	Dual-Title
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=CIED)

Students earn a dual-title degree in this option through participating programs at either the Ph.D. (or D.Ed.) or the M.A., M.S., M.Ed. level. Students receive a degree which lists their major program and Comparative and International Education.

The following graduate programs offer dual-title degrees in Comparative and International Education:

- Agricultural and Extension Education
- Curriculum and Instruction
- Counselor Education
- Educational Leadership
- Educational Psychology
- Educational Theory and Policy
- Entomology
- Higher Education
- Learning, Design, and Technology
- Lifelong Learning and Adult Education
- School Psychology
- Special Education
- Workforce Education and Development

The Comparative and International Education dual-title degree program is administered by the Committee on Comparative and International Education. The committee maintains program definition, identifies courses appropriate to the dual-title, develops and administers the program's comprehensive examination, and recommends policy and procedures for the program's operation to the dean of the College of Education and to the dean of the Graduate School. Members of the committee also chair or co-chair the dissertation committees for students electing the dual-title doctoral degree.

The dual-title degree program is offered through participating programs in the College of Education and, where appropriate, other graduate

programs in the University. The dual-title program enables students from several graduate programs to gain the perspectives, techniques, and methodologies of comparative and international education, while maintaining a close association with program areas of application. Comparative and international education is a field devoted to the systematic analysis of the operation and effects of the world's education systems.

Admission Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

For admission to pursue a dual-title degree under this program, a student must apply to:

1. the Graduate School;
2. one of the participating graduate major programs; and
3. the Committee on Comparative and International Education.

Students must apply and be admitted to their primary graduate program and The Graduate School before they can apply for admission to the Comparative and International Education dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Comparative and International Education dual-title program. Doctoral students must be admitted into the dual-title degree program in Comparative and International Education prior to taking the qualifying examination in their primary graduate program.

In addition to materials submitted for admission to the major program, candidates to the dual-title degree program will be required to provide a writing sample, and to submit a written personal statement indicating the career goals they hope to serve by attaining a Comparative and International Education degree.

Degree Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Master's Degrees

To qualify for a dual-title degree, students must satisfy the requirements of the graduate major programs in which they are enrolled, in addition to the minimum requirements of the Comparative and International Education program.

For the M.A., M.S., or M.Ed. dual-title degree in Comparative and International Education, the minimum course requirements are:

- 3 credits in the required Proseminar in Comparative and International Education CIED 500;
- 6 credits in advanced Comparative and International Education courses;
- and 3 credits in Comparative and International Education content courses.

A master's thesis or master's paper, if required by the student's graduate major program, must include one reader who is a member of the Committee on Comparative and International Education.

Doctoral Degrees

To qualify for a dual-title degree, students must satisfy the requirements of the graduate major programs in which they are enrolled, in addition to the minimum requirements of the Comparative and International Education program.

The minimum course requirements for the Ph.D. or D.Ed. dual-title degree in Comparative and International Education are:

- 3 credits in the Proseminar in Comparative and International Education CIED 500;
- 6 credits in advanced Comparative and International Education courses;
- 12 credits in Comparative and International Education content courses or courses with comparative or international content;
- and 6 credits in research methods.

Students are expected to be fluent in reading, writing, and speaking English, and must demonstrate competency in reading a language other than English, preferably a language relevant to a country or geographic area they propose to study. (This foreign language requirement can be satisfied by passing the appropriate ETS Language Achievement Test, or by passing the appropriate Penn State foreign language course.) A minimum of 18 credits must be 500-level course, and particular courses may satisfy both the graduate major program requirements and those in the Comparative and International Education program.

The qualifying examination committee for the dual-title Ph.D. degree must include at least one Graduate Faculty member from the Comparative and International Education program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both the primary graduate degree program and Comparative and International Education. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Comparative and International Education dual-title doctoral degree student must include at least one member of the Comparative and International Education Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Comparative and International Education, the member of the committee representing Comparative and International Education must be appointed as co-chair. The Comparative and International Education representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in both their primary graduate program and Comparative and International Education. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree.

The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

Requirements listed here are in addition to requirements for minors in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

A doctoral minor program in Comparative and International Education is available to doctoral students who find it desirable to include the perspectives and methodologies of Comparative and International Education in their programs and have been approved to do so by their dissertation committees. To qualify for a minor in Comparative and International Education, students must satisfy the requirements of their graduate major programs, and meet the following minimum requirements:

- 3 credits in the Proseminar in Comparative and International Education CIED 500 (<https://bulletins.psu.edu/search/?P=CIED%20500>);
- 3 credits in a Comparative and International Education course;
- and 9 credits in Comparative and International Education content courses (or advanced courses) or in courses with comparative or international content offered outside the College of Education.
-

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Comparative and International Education (CIED) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/cied/>)

Learning Outcomes

Master's Degrees

1. Demonstrate mastery of the student's specific program emphasis area, which includes knowledge of primary and secondary literature related to research methodologies, programmatic research priorities, and implications of that research for professional practice. Assessed through methods and theory coursework.
2. Students will design and carry out a research project that includes articulating an important and original question, analyzing appropriate literature, demonstrating conceptual and methodological creativity,

and carrying out an original inquiry. Assessed through master's thesis/paper.

3. Demonstrate critical thinking about selected recent research in the program emphasis area through the description of an emerging scholarly theme/area, identification of specific publications that reflect it, and assessment of its strengths and weaknesses. Assessed through coursework and master's thesis/ paper.
4. Demonstrate standards of field in written and oral communication by requiring research presentations in several courses. In addition, presentations at CIES are strongly encouraged.
5. Demonstrate knowledge and comprehension of research ethics issues including knowledge of ethical principles related to authorship, research reporting, data fabrication, plagiarism, conflicts of interest, peer review, data sharing and other areas of misconduct. Assessed through SARI examinations and participation in CIED 500.
6. Participate in conducting research with faculty, working on the boards of professional journals, or other significant professional engagement as identified by the master's adviser.

Doctoral Degrees

1. Demonstrate mastery of the student's specific program emphasis area, which includes knowledge of theoretical and methodological literature, programmatic research priorities, and implications of that research for professional practice. Assessed through the appropriate course work and dissertation proposal.
2. Students will design and carry out a research project that includes articulating an important and original question, analyzing appropriate literature, demonstrating conceptual and methodological creativity, and carrying out an original inquiry. Assessed through dissertation proposal and defense.
3. Demonstrate critical thinking about selected recent research in the program emphasis area through the description of an emerging scholarly theme/area, identification of specific publications that reflect it, and assessment of its strengths and weaknesses. Assessed through dissertation proposal.
4. Demonstrate standards of field in written and oral communication by (a) preparing a research grant proposal for an award competition or an internal or external funding opportunity, and (b) presenting the results of dissertation research in clear, concise oral presentations to an audience of peers. Assessed through research/award proposal and dissertation defense. In addition, presentations at CIES are strongly encouraged.
5. Demonstrate knowledge and comprehension of research ethics issues including knowledge of ethical principles related to authorship, research reporting, data fabrication, plagiarism, conflicts of interest, peer review, data sharing and other areas of misconduct. Assessed through SARI examinations and participation in CIED 500.
6. Participate in conducting research with faculty, working on the boards of professional journals, teaching an undergraduate or graduate course, or other significant professional engagement as identified by the doctoral adviser. Assessed through faculty written evaluation, standardized assessment instruments, and/or other appropriate and clearly defined means.

Contact

Campus	University Park
Graduate Program Head	Kevin Kinser
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Soo-yong Byun
Program Contact	Cassie Joyce Vomero 300 Rackley Building University Park PA 16802 cjm313@psu.edu (814) 865-1488
Program Website	View (https://ed.psu.edu/academics/departments/departments-education-policy-studies/comparative-and-international-education/)

Comparative Literature

Graduate Program Head	Charlotte Eubanks
Program Code	CMLIT
Campus(es)	University Park (Ph.D., M.A.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Arts (M.A.) Dual-Title Ph.D. in Comparative Literature and African Studies Dual-Title Ph.D. in Comparative Literature and Asian Studies Dual-Title Ph.D. in Comparative Literature and Visual Studies Dual-Title Ph.D. in Comparative Literature and Women's, Gender, and Sexuality Studies Integrated B.A. in Comparative Literature and M.A. in Comparative Literature
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=CMLIT)

The M.A. and Ph.D. programs in Comparative Literature offer a global breadth of study of literature and other cultural productions. Drawing upon multiple languages and cultural contexts, students consider new configurations such as the Global South or Inter-American studies as well as traditional regions of comparison. Students combine a shared series of seminars in comparative research methods and theory (ancient through very current) with coursework in their own areas of interest. In addition to specializations including—but not limited to—comparative medieval studies; comparative Middle Eastern studies; comparative modernisms; ecocriticism and the Anthropocene; human rights, ethics, and critical health studies; migration, diaspora, and globalization; poetry and poetics; postcolonial and decolonial studies; translation studies; and world literature, doctoral students can take an interdisciplinary dual-title degree with African Studies, Asian Studies, Visual Studies, or Women's, Gender, and Sexuality Studies. Our graduate programs emphasize research experience, pedagogical theories and practice, and career preparation.

The M.A. is a general humanistic degree that helps prepare students for a variety of situations, including teaching in private high schools or community colleges, or further graduate work. The Ph.D. is a more

specialized degree. The Ph.D. in Comparative Literature can be combined with a minor in a professional field such as teaching English as a second language. Other potential combinations include our dual-title Ph.D. programs in:

- Comparative Literature and African Studies
- Comparative Literature and Asian Studies
- Comparative Literature and Visual Studies
- Comparative Literature and Women's, Gender, and Sexuality Studies

Only the faculty members and courses officially associated with the Department of Comparative Literature are listed here. Faculty members and courses in other departments are also available to comparative literature students according to their preparation.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students with appropriate course backgrounds and at least a 3.00 junior/senior average (on a 4.00 scale) will be considered for admission. The admission process is highly competitive and the best qualified students will be admitted subject to space availability.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Most students who do graduate work in comparative literature hold a B.A. or M.A. degree in comparative literature or in a particular language and literature. Students completing degrees in such fields are welcome to apply—as are students in other humanistic fields, such as philosophy or history, if they have studied literature.

For admission to the M.A. program, students should be prepared to study at least one foreign literature in its own language. For admission to the Ph.D. program, students should be prepared to study at least two foreign literatures in their own language. Doctorate-seeking students usually complete the M.A. before being formally admitted to the Ph.D. program, but exceptional students may be admitted from the B.A. level directly to the Ph.D. Students are encouraged to plan a unified M.A./Ph.D. program if they take both degrees here; however, Ph.D. applications are welcomed from students holding or completing an M.A. elsewhere.

Degree Requirements

Master of Arts (M.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A minimum of 30 credits at the 400, 500, or 800 level is required, with at least 18 credits at the 500 level. There are 9 credits required in the following core courses: CMLIT 501, CMLIT 502, and CMLIT 503. In addition, 18 credits in comparative literature courses and other literature courses are required, with at least 6 credits in non-Anglophone literature. The culminating experience for the degree is a satisfactory master's

paper completed while the student is enrolled in CMLIT 596. Students must demonstrate advanced proficiency in at least two languages (one may be English).

Students pursuing a graduate degree in comparative literature have individualized programs of study within the requirements specified above. For example, one student may emphasize film and new media; another, the novel. One student may concentrate on earlier literatures; another, on international modernism. One student may be interested primarily in the European tradition; another, in literatures. In such a program, the relationship between student and adviser is important. Each graduate student works with faculty advisers familiar with comparative studies as a whole and with the student's particular area of interest.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Requirements for the Ph.D. in comparative literature include:

- 9 credits total in 3 required courses: CMLIT 501, CMLIT 502, and CMLIT 503—with substitute courses if these have been used in the M.A. program;
- at least an additional 24 credits in literature courses, including course work in the three languages that the student selects, with emphasis on the student's primary literature—students should organize their course work, as much as possible, around a unifying principle, such as genre, period, or theme;
- passing a qualifying examination;
- proficiency in two foreign languages;¹
- passing a comprehensive examination; and
- a written dissertation and passing a final oral examination (the dissertation defense). The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

1 The foreign languages are to be prepared at a level that permits thorough literary analysis of texts and related material in those languages.

Students pursuing a graduate degree in comparative literature have individualized programs of study within the requirements specified above. For example, one student may emphasize film and new media; another, the novel. One student may concentrate on earlier literatures; another, on international modernism. One student may be interested primarily in the European tradition; another, in literatures. In such a program, the relationship between student and adviser is important. Each graduate student works with faculty advisers familiar with comparative studies as a whole and with the student's particular area of interest.

Dual-Titles

Dual-Title Ph.D. in Comparative Literature and African Studies

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Comparative Literature doctoral students who have research and educational interests in African Studies may apply to the Dual-Title Doctoral Degree Program in African Studies. The goal of the program is to enable doctoral students from Comparative Literature to complement their knowledge and skills in their primary discipline with in-depth knowledge of prevailing theories on and problem-solving approaches to thematic, regional, or national issues pertaining to African development and change.

The Dual-Title Doctoral Degree Program will provide interested Comparative Literature doctoral students with a multidisciplinary approach that will enhance their analytical capabilities for addressing key issues in African Studies. It will, thereby, add value to their Comparative Literature degree and should increase their competitiveness in the job market. The well-rounded specialist who graduates from the program may be employed in an international setting and have enhanced opportunities for U.S. academic and non-academic positions as well.

Admission Requirements

Students must apply and be admitted to the graduate program in Comparative Literature and The Graduate School before they can apply for admission to the dual-title degree program. Applicants interested in the dual-title degree program may make their interest in the program known clearly on their applications to Comparative Literature and include remarks in their statement of purpose that address the ways in which their research and professional goals in the primary department reflect an interest in African Studies-related research.

To be enrolled in the Dual Title Doctoral Degree Program in African Studies, a student must have the approval of the Comparative Literature department and then submit a letter of application and transcript, which will be reviewed by an African Studies Admissions Committee. Refer to the Admission Requirements section of the African Studies (<http://bulletins.psu.edu/graduate/programs/majors/african-studies/>) Bulletin page. An applicant must have a minimum grade point average of 3.0 (on a 4 point scale) to be considered for enrollment in the dual-title degree program. Students must apply for enrollment into the dual-title degree program in African Studies prior to taking the qualifying examination in Comparative Literature.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the requirements of the Comparative Literature doctoral program in which they are primarily enrolled. In addition, they must satisfy the requirements described below, as established by the African Studies Program. Within this framework, course selection is determined by the student with the approval of the Comparative Literature and African Studies academic advisers.

Upon acceptance by the African Studies admissions committee, the African Studies director will assign the student an African Studies academic adviser in consultation with the African Studies admissions committee.

As a student develops specific scholarly interests, s/he may request a different African Studies adviser from the one assigned by the African Studies admissions committee. The student and the Comparative Literature and African Studies academic advisers will establish a program of study that is appropriate for the student's professional objectives and that is in accordance with the policies of the Graduate Council, the Comparative Literature graduate program, and the African Studies Program.

Course work

The Ph.D. in Comparative Literature and African Studies is awarded to students who are admitted to the Comparative Literature doctoral program and admitted subsequently into the dual-title degree in African Studies. The minimum course requirements for the dual-title Ph.D. degree in Comparative Literature and African Studies are as follows:

- A minimum of 60 postbaccalaureate credits. Course work accepted for the M.A. in Comparative Literature will count toward the 60-credit requirement. At least 45 credits, exclusive of dissertation research credits, must be in Comparative Literature.
- AFR 501
- 15 credits of African-related coursework at the 400- or 500-level; a minimum of 6 of these credits must be taken from a list of courses maintained by the African Studies program chair.
- Up to 6 of the 15 credits may come from Comparative Literature, as approved by the student's Comparative Literature and African Studies Program academic advisors.
- The remaining credits can be taken in AFR or in any department other than Comparative Literature.
- Of the 15 credits, no more than 6 credits may be taken at the 400-level and no more than 3 combined credits may come from AFR 596 and AFR 599 listings.

The choice of courses in African Studies is to be proposed by the student subject to approval by the Comparative Literature and African Studies academic advisers. The suite of selected courses should have an integrated, intellectual thrust that probes thematic, national, or regional issues and that is complementary to the student's specialty in Comparative Literature.

Language Requirement

Fulfillment of communication and foreign language requirements will be determined by the student with approval of the Comparative Literature and African Studies program advisers and will meet the existing Comparative Literature requirements. The Ph.D. in Comparative Literature requires proficiency in two foreign languages. The foreign languages are to be prepared at a level that permits thorough literary analysis of texts and related material in those languages.

Qualifying Exam

The dual-title degree will be guided by the Qualifying Exam procedure of the Comparative Literature graduate program. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable. There will be a single qualifying examination, containing elements of both the major discipline and African Studies.

The qualifying examination committee for the dual-title degree will be composed of Graduate Faculty from Comparative Literature and must include a Graduate Faculty member from the African Studies Program. The designated dual-title faculty member may be appointed from Comparative Literature if that person holds a formal affiliation with the African Studies program.

Ph.D. Committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Comparative Literature and African Studies dual-title Ph.D. student must include at least one member of the African Studies Graduate Faculty. Faculty members who hold appointments in both

programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in African Studies, the member of the committee representing African Studies must be appointed as co-chair.

Comprehensive Exam

After completing most course work, students in the dual-title doctoral degree program in Comparative Literature and African Studies must pass a comprehensive examination that includes written and oral components. Written components will be administered on a student's examination fields according to the current Comparative Literature exam structure, and on African Studies. The African Studies representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination. The African Studies component of the exam will be based on the student's thematic, national, or regional area(s) of interest and specialization in African Studies.

Dissertation and Dissertation Defense

Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. Students enrolled in the dual-title program are required to write and orally defend a dissertation on a topic that reflects their original research and education in Comparative Literature and African Studies. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title Ph.D. in Comparative Literature and Asian Studies

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Graduate students with research and educational interests in Asian Studies may apply to the Comparative Literature/Asian Studies Degree Program. The goal of the dual-title degree in Comparative Literature and Asian Studies is to enable graduate students from Comparative Literature to acquire the knowledge and skills of their major area of specialization in Comparative Literature while at the same time gaining the perspective of Asian Studies.

In order to prepare graduate students for the competitive job market, this program provides them with a solid disciplinary foundation that will allow them to compete for the best jobs in their field. For such students the dual-title Ph.D. in Asian Studies will add value to their degree and their status as candidates. It will produce excellent scholars of literature who are experts in Asian Studies as well. The dual-title degree Comparative Literature and Asian Studies will build curricular bridges beyond the student's major field so as to provide a unique training regime for the global scholar.

Admission Requirements

Students must apply and be admitted to the graduate program in Comparative Literature and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admission requirements of the Asian Studies dual-title program. Refer to the Admission Requirements section of the Asian Studies (<http://bulletins.psu.edu/graduate/programs/majors/asian-studies/>) Bulletin page. The Asian Studies admissions committee reviews applications forwarded by Comparative Literature, and recommends students for admission to the Asian Studies program to the Graduate School. Students already in their first and second years of the Comparative

Literature graduate program may also apply to the dual-title program if their applications are forwarded by Comparative Literature. Doctoral students must be admitted into the dual-title degree program in Asian Studies prior to taking the qualifying examination in their primary graduate program.

Students with appropriate course backgrounds and a 3.00 junior/senior average (on a 4.00 scale) will be considered for admission. The admission process is highly competitive and the best qualified students will be admitted subject to space availability. Scores from the Graduate Record Examination (GRE) are required for admission.

There are no specific requirements for admissions into the dual-title program beyond the requirements of the Graduate School and Comparative Literature, though applicants interested in the program should also make their interest in the dual-title program known clearly on their application for admission to the Comparative Literature program and include remarks in their essays that explain their training, interests, and career goals in an area of Asian Studies.

Degree Requirements

To qualify for an Asian Studies degree, students must satisfy the requirements of the Comparative Literature program in which they are primarily enrolled. In addition, they must satisfy the requirements described below, as established by the Asian Studies Program (<http://bulletins.psu.edu/graduate/programs/majors/asian-studies/>). Within this framework, final course selection is determined by the students, their Asian Studies adviser, and their Comparative Literature program adviser.

Upon a student's acceptance by the Asian Studies admissions committee, the student will be assigned an Asian Studies academic adviser in consultation with the Asian Studies chair. As students develop specific scholarly interests, they may request that a different Asian Studies faculty member serve as their adviser. The student and adviser will discuss a program of study that is appropriate for the student's professional objectives and that is in accord with the policies of The Graduate School, the Comparative Literature department and the Asian Studies program.

Course work

The dual-title Ph.D. degree in Comparative Literature and Asian Studies is awarded only to students who are admitted to the Comparative Literature doctoral program and admitted to the dual-title degree in Asian Studies. The minimum course requirements for the dual-title Ph.D. degree in Comparative Literature and Asian Studies are as follows:

- CMLIT 501, CMLIT 502, and CMLIT 503
- 15 credits of Asia-related coursework at the 400 or 500 level. At least 6 of these 15 credits will be from ASIA 501 and ASIA 502. As many as 6 may come from Comparative Literature, as approved by the student's doctoral adviser and the ASP director of graduate studies. The remaining credits can be taken in ASIA or in any department other than Comparative Literature.
- An additional 21 credits in literature or theory-related courses, including graduate course work in the three languages that the student selects, with emphasis on the student's primary literature

Particular courses may satisfy both the Comparative Literature requirements and those of the Asian Studies program. Within this framework, final course selection is determined by the students, their Asian Studies adviser, and their Comparative Literature program adviser.

Qualifying Examination

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Comparative Literature and must include at least one Graduate Faculty member from the Asian Studies program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Comparative Literature and Asian Studies. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

Ph.D. Committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Comparative Literature and Asian Studies dual-title Ph.D. student must include at least one member of the Asian Studies Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Asian Studies, the member of the committee representing Asian Studies must be appointed as co-chair. The Asian Studies representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Dissertation and Dissertation Defense

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Comparative Literature and Asian Studies. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title Ph.D. in Comparative Literature and Visual Studies

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Comparative Literature graduate students who have research and educational interests in global visual culture may apply to the Dual-Title Doctoral Program in Visual Studies. The program aims to (a) provide students with the conceptual and methodological tools they will use to interpret literature and its history in global contexts; (b) help them develop a comprehensive understanding of literary systems, processes, and networks across languages, cultures, and media; and (c) guide them in using their specialized knowledge and skills to produce research of publishable quality. The program prepares graduates for college and university teaching, and careers in other related fields.

The dual-title Ph.D. in Visual Studies comprises two core components:

1. historical and theoretical analysis of various forms of visual culture, their diverse sources, and their current manifestations;
2. historical and theoretical analysis of visual media in the information age, including the visual aspects of the digital humanities and the presentation of scholarship and teaching in visual media.

A program-specific required course in each of these areas will ensure breadth of training for participating students. Together these components will offer students a sophisticated understanding of and ability to intervene in debates about visual culture and visuality in the world today.

Admission Requirements

Students must apply and be admitted to the doctoral program in Comparative Literature and The Graduate School before they can apply for admission to the dual-title degree program. Applicants interested in the dual-title degree program may make their interest in the program known clearly in their applications to Comparative Literature and include remarks in their statement of purpose that address the ways in which their research and professional goals in the primary department reflect an interest in Visual Studies-related research. After admission to the doctoral program, students must apply for admission to and meet the admissions requirements of the Visual Studies dual-title program, as described in the Admission Requirements section of the Visual Studies Bulletin (<http://bulletins.psu.edu/graduate/programs/majors/visual-studies/>). Doctoral students must be admitted into the dual-title degree program in Visual Studies prior to taking the qualifying examination in the Comparative Literature program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the Ph.D. in Comparative Literature, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual-title in Visual Studies, listed on the Visual Studies Bulletin (<http://bulletins.psu.edu/graduate/programs/majors/visual-studies/>)page.

Coursework

The program will consist of a total of fifteen credits, including two required courses – Visual Culture Theory and History (VSTUD 501) and Visual Digitality (VSTUD 502) – and three elective courses dealing with questions of visuality, chosen in consultation with the Director of Graduate Studies for Comparative Literature. Up to six credits may be double-counted by both the primary graduate program (CMLIT) and the dual-title.

Language Requirements

There are no additional language requirements for the dual-title degree (the usual doctoral requirements of the Department of Comparative Literature are to be followed).

Qualifying Examination

The dual-title field will be fully integrated into the qualifying exam for the doctoral program. The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Comparative Literature and must include at least one Graduate Faculty member from the Visual Studies program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. In addition, student in the dual- title Ph.D. in Visual Studies will be required to present to their committee a portfolio of work in Visual Studies, consisting of a statement of the student's interdisciplinary research interests, a program plan, and samples of writing that indicate the student's interest in questions related to Visual Studies.

Because students must first be admitted to a graduate major program of study before they may apply to and be considered for admission into a dual-title graduate degree program, dual-title graduate degree students may require an additional semester to fulfill requirements for both areas

of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

Ph.D. Committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Comparative Literature and Visual Studies dual-title Ph.D. student must include at least one member of the Visual Studies Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the committee chair does not represent Visual Studies, a committee member representing Visual Studies must be appointed as co-chair.

Comprehensive Exam

After completing most course work, doctoral students in the dual-title doctoral degree program in Comparative Literature and Visual Studies must pass a comprehensive examination that includes written and oral components. Written components will be administered on a student's examination fields according to the current Comparative Literature exam structure. The faculty member representing Visual Studies on the student's committee will participate in developing, administering, and evaluating the student's comprehensive exams.

Dissertation and Dissertation Defense

Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. Students enrolled in the dual-title program are required to write and orally defend a dissertation on a topic that reflects their original research and education in Comparative Literature and Visual Studies. The dissertation must be accepted by the Ph.D. committee, the head of the Comparative Literature program, and the Graduate School.

Dual-Title Ph.D. in Comparative Literature and Women's, Gender, and Sexuality Studies

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Comparative Literature graduate students who have research and educational interests in women's, gender, and sexuality studies may apply to the Dual-Title Doctoral Program in Women's, Gender, and Sexuality Studies. The program creates a formal structure for training graduate students to describe, analyze, and evaluate the practices, phenomena, and policies that both issue from and structure the experiences and possibilities of women, as well as training for students to analyze how gender and sexuality intersect with literary production in multiple societies. This training cultivates breadth by pushing students to think across disciplines, geographic regions, geopolitical boundaries, domains of practice, aesthetic fields, literary genres, and historical eras. It also balances this breadth with rigor: it combines systematic training in comparative literary research, including working with primary sources in languages other than English, with a thorough grounding in the techniques and intellectual resources of state of the art scholarship on women, gender, and sexuality.

The Dual-Title Doctoral Degree Program in Comparative Literature and Women's, Gender, and Sexuality Studies has three broad learning objectives at its core (in addition to the objectives that animate the regular doctoral program in Comparative Literature). Students will leave

the program with expert awareness of responsibly produced knowledge and ethical research techniques for producing new knowledge, about:

1. the forces that constitute, shape, distinguish, and link the lives of women in a variety of historical and geographic locations;
2. ways to understand the history of women, of gender, and of sexuality in global perspectives and specific local and linguistic contexts, with emphases on the relation of these fields to the history of the aesthetic, as well as to a variety of other economic, social, or philosophical structures that help determine the natures of gender and the lives of women; and
3. the history, content, conceptual options, and ethical stakes of the theoretical debates about the best ways to engage in the field of Women's, Gender, and Sexuality Studies.

Admission Requirements

Students must apply and be admitted to the graduate program in Comparative Literature and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Women's, Gender, and Sexuality Studies dual-title program. Refer to the Admission Requirements section of the Women's, Gender, and Sexuality Studies Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/womens-gender-sexuality-studies/>). Students must have the approval of the Comparative Literature graduate director to apply for the dual-title. The application must include a statement of purpose that addresses how the student's research and professional goals intersect with the objectives of the dual-title graduate degree program in Comparative Literature and Women's, Gender, and Sexuality Studies. The Women's, Gender, and Sexuality Studies Admissions Committee reviews applications and recommends students for admission to the dual-title Ph.D. program. Doctoral students must be admitted into the dual-title degree program in Women's, Gender, and Sexuality Studies prior to passing the qualifying examination in their primary graduate program.

Students may apply to the dual-title program when they request admission to the Comparative Literature Department, or at any time prior to taking the qualifying exam in Comparative Literature, provided that they

1. secure the approval of the graduate director in Comparative Literature, and
2. have sufficient funding and time to complete the dual-title requirements.

Practically speaking, this will likely mean applying to the dual-title program before completing the second year of study in Comparative Literature.

Degree Requirements

The doctoral degree in Comparative Literature and Women's, Gender, and Sexuality Studies is awarded only to students who are admitted to the Comparative Literature doctoral program and admitted to the dual-title degree in Women's, Gender, and Sexuality Studies. To qualify for a degree in Comparative Literature and Women's, Gender, and Sexuality Studies, students must satisfy the requirements of the Comparative Literature program, in which they are primarily enrolled, and of the Women's, Gender, and Sexuality Studies (<https://bulletins.psu.edu/graduate/programs/majors/womens-gender-sexuality-studies/>) dual-title program (<https://bulletins.psu.edu/graduate/programs/majors/womens-gender-sexuality-studies/>). Except where noted otherwise, students must complete the requirements listed below *in addition to* completing the general

requirements for doctoral study in the Department of Comparative Literature.

Course work

The minimum course requirements for this dual-title Ph.D. degree are 18 credits of coursework related to Women's, Gender, and Sexuality Studies. Of these 18 credits, 9 consist of the required core course sequence in Women's, Gender, and Sexuality Studies:

Code	Title	Credits
WMNST 501		3
WMNST 507	Feminist Theory	3
WMNST 502	Global Feminisms	3

Students also must complete 9 additional credits of Women's, Gender, and Sexuality Studies course work chosen in consultation with the Graduate Director in Women's, Gender, and Sexuality Studies. Most of these courses (at least 5 credits) should be at the 500 level, but a student may count some 400-level credits, with the approval of the Graduate Director in Women's, Gender, and Sexuality Studies. Particular courses may simultaneously satisfy degree requirements in Comparative Literature and in the Women's, Gender, and Sexuality Studies dual-title. Students who already hold a master's degree or other graduate credits from another institution may petition the Graduate Director in Women's, Gender, and Sexuality Studies to have equivalent course credits accepted.

Language Requirements

There are no additional language requirements for the dual-title degree (the usual doctoral requirements of the Department of Comparative Literature are to be followed).

Qualifying Examination

The dual-title field must be fully integrated into the qualifying exam for the doctoral program. In addition, students in the dual-title Ph.D. in Comparative Literature and Women's, Gender, and Sexuality Studies program will be required to present to their committee a portfolio of work in Women's, Gender, and Sexuality Studies which includes:

- a statement of the student's interdisciplinary research interests,
- a program plan,
- and samples of writing that indicate the student's interest in questions taken up by scholars of Women's, Gender, and Sexuality Studies.

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Comparative Literature and must include at least one Graduate Faculty member from the Women's, Gender, and Sexuality Studies program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

Ph.D. Committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Comparative Literature and Women's, Gender, and Sexuality Studies dual-title Ph.D. student must include at least two members of the Comparative Literature Graduate Faculty and two members of the Women's, Gender, and Sexuality Studies Graduate Faculty. Faculty members who hold appointments in both programs'

Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Women's, Gender, and Sexuality Studies, the member of the committee representing Women's, Gender, and Sexuality Studies must be appointed as co-chair.

Comprehensive Exams

The faculty member representing Women's, Gender, and Sexuality Studies on the student's committee will participate in developing, administering, and evaluating the student's comprehensive exams. The exam will incorporate written and oral components based on the student's thematic or regional areas of interest and specialization and may include questions on queer theory, feminist methodology, global women's studies and sexuality studies in Comparative Literature.

Dissertation and Final Oral Examination (Dissertation Defense)

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Comparative Literature and Women's, Gender, and Sexuality Studies. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Integrated Undergrad-Grad Programs

Integrated B.A. in Comparative Literature and M.A. in Comparative Literature

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.A. in Comparative Literature with the M.A. in Comparative Literature offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- University Park

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The Department of Comparative Literature offers an integrated B.A./M.A. program that is designed to allow academically superior baccalaureate students to obtain both the B.A. and the M.A. degrees in Comparative Literature within five years of study. The first two years of undergraduate course work include the University General Education and Liberal Arts requirements in addition to language and literature study in the major. In the third year, students are expected to define areas of interest in two primary literatures in different languages. In addition, students in the B.A./M.A. program should begin to undertake work in a second foreign language. The fourth year includes graduate-level work in methodology and the student's selection of primary literatures, which replaces comparable 400-level senior year courses. The fifth and final year of the program typically consists of graduate work in Comparative Literature courses as well as the chosen literatures. The program culminates with an M.A. paper.

By encouraging greater depth and focus in the course of study beginning in the third undergraduate year, this program helps students more clearly define their area of interest and expertise in the otherwise vast field of international literatures. As a result, long-range academic planning for exceptional students pursuing doctoral degrees after leaving Penn State, or other professional goals, will be greatly enhanced. The student may also be more competitive in applying for admission to Ph.D. programs as well as for institutional and national grant monies and scholarships.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The number of openings in the integrated B.A./M.A. program is limited. Admission is selective based on specific criteria and the unqualified recommendation of faculty. Applicants to the integrated program:

1. Must be enrolled in the Comparative Literature B.A. program.
2. Must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. It is strongly suggested that students apply to the program prior to completing 100 credits. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.
3. Must be accepted without reservation into the M.A. program in Comparative Literature. Students must apply to the program via the Graduate School application for admission (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet all the admission requirements of the Graduate School and the Comparative Literature graduate program for the Master of Arts degree, listed on the Admission Requirements tab.
4. Should have a recommended overall GPA of 3.2 (on a 4.0 scale) in undergraduate coursework and a minimum GPA of 3.5 in all coursework completed for the major.
5. Must present a departmentally approved plan of study in the application process. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.
6. Must be recommended by the chairs of the Department's undergraduate and graduate committees.

Degree Requirements

A typical sequence of course work for the integrated program would appear as follows:

- Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.A. in Comparative Literature are listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.A. degree are listed on the Degree Requirements tab. Up to 9 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted. Because the B.A./M.A. is an *integrated* (rather than a sequential) degree program students are encouraged to gradually

increase the number of graduate courses taken for credit. (See chart of suggested progress below.) Still, students should satisfy all of the B.A. requirements (including double-counted classes), before taking courses that count *only* toward the M.A. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.A. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

- CMLIT 501 will double-count for both degrees, and will replace CMLIT 400Y (a core requirement of the B.A.-only program). Students enrolled in the Integrated B.A./M.A. program can also double-count two further 500-level courses (CMLIT 502 and CMLIT 503) toward both the B.A. and the M.A. degrees.

First Year	Credits
CMLIT 10	3
CMLIT 100	3
	6
Second Year	Credits
Foreign Language (beyond the 12-credit level)	6
Courses in Literature	6
	12
Third Year	Credits
400-level courses in Literature	6
CMLIT 501	3
Work in foreign language (credits do not count towards the major, but reading proficiency is required for the M.A. degree)	
	9
Fourth Year	Credits
CMLIT 502 or 503	3
Comparative Literature courses	6
500-level courses in Literatures (at least 3 credits in non-Anglophone literature)	6-9
	15-18
Fifth Year	Credits
CMLIT 502 or 503	3
500-level courses in Literatures (at least 3 credits in non-Anglophone literature)	9-12
500-level Comparative Literature Courses M.A. paper	6
	18-21
Total Credits 60-66	

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

graduate-education-policies/), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Teaching assistantships in the Department of Comparative Literature, as well as in related language and literature departments, typically have been available to students taking comparative literature degrees. In recent years, Comparative Literature students have held assistantships in Arabic, Chinese, English, French, German, Hebrew, Italian, Japanese, Russian, Spanish, Swahili, and Women's Studies, as well as in Comparative Literature courses. There also is a graduate assistantship position for an editorial assistant to the journal *Comparative Literature Studies*, which is edited in the department. In addition, the following awards typically have been available to graduate students in this program.

Samuel P. Bayard Award

Available annually to a graduate student in comparative literature, selected by the graduate committee of the Department of Comparative Literature. Amount varies.

Edwin Erle Sparks Fellowships in the Humanities

Available to beginning and continuing graduate students in the following graduate programs:

- Comparative Literature
- English
- French
- German
- History
- Philosophy
- Spanish
- Communication Arts and Sciences

Folger Institute Fellowships

Penn State is a member of the Folger Institute of Renaissance and Eighteenth-Century Studies. Graduate students in Comparative Literature

are eligible for Folger Institute Fellowships to study in seminars and workshops at the Folger Library, Washington, D.C.

Title VI Center for Global Studies Assistantship

Available to beginning and continuing graduate students in Comparative Literature and other programs.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Comparative Literature (CMLIT) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/cmlit/>)

Learning Outcomes

Master of Arts (M.A.)

1. Graduates will demonstrate knowledge of literature and critical theory from a global perspective, in multiple languages and media, and across a broad range of historical periods.
2. Graduates will demonstrate their development of new knowledge in the discipline, by designing and executing a sustained piece of scholarship (MA Paper) that brings their newly created knowledge into conversation with on-going debates in the discipline.
3. Graduates will demonstrate the ability to participate appropriately in a variety of professional situations, including seminars, lectures, and, when feasible and advisable, conferences or teaching.

Doctor of Philosophy (Ph.D.)

1. Graduates will demonstrate knowledge of literature and critical theory from a global perspective, in multiple languages and media, and across a broad range of historical periods.
2. Graduates will demonstrate the ability to organize disciplinary knowledge through the creation of syllabi, by discussing and thinking about their teaching in ways that reflect current pedagogical practice and theory, and, as feasible, by teaching introductory and advanced concepts and topics appropriate to their field.
3. Graduates will demonstrate their development of new knowledge in the discipline, by designing and executing a sustained piece of scholarship (the dissertation) that brings their newly created knowledge into conversation with on-going debates in the field.
4. Graduates will demonstrate the mastery of conventions for presenting research suitable for presentation at professional conferences and for writing articles suitable for submission to literary journals.
5. Graduates will demonstrate the ability to participate appropriately in a variety of professional situations, including seminars, lectures, conferences, and job interviews.

Contact

Campus	University Park
Graduate Program Head	Charlotte Eubanks
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Rosemary Jane Jolly
Program Contact	William Whitesmith 442 Burrowes Bldg. University Park PA 16802 wmw5235@psu.edu (814) 863-3522
Program Website	View (http://complit.la.psu.edu/)

Computer Science

Graduate Program Head	Vahid Motevalli
Program Code	COMP
Campus(es)	Harrisburg (M.S.)
Degrees Conferred	Master of Science (M.S.) Integrated B.S. in Computer Science and M.S. in Computer Science
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=COMP)

The program is professionally oriented and designed to prepare students for employment in industry or government. Courses emphasize practical concerns as well as the relevant theoretical background. The program will provide appropriate background for diverse tasks such as:

- developing scientific and engineering applications,
- developing system software,
- developing safety or security critical systems,
- solving computationally hard problems, and
- developing distributed applications.

While not intended as preparation for subsequent entrance to a Ph.D. program, this goal is not precluded. Once the specific course requirements are met, appropriate selection of electives will enable individual interests to be met within the program.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Applicants must present a baccalaureate degree in Computer Science or a related field from a regionally accredited institution. A minimum GPA of 2.75 (on a 4.0 scale) is required. While a bachelor's degree in Computer Science is not required, admission without deficiency requires that an applicant has completed courses in analysis of algorithms, operating systems, database, and linear algebra. If these courses are not taken before admission to the program, they may be taken at Penn State Harrisburg, but the student will receive at most 3 credits toward the M.S. degree for these courses.

At the discretion of the program, applicants may be required to provide scores from the Graduate Record Examinations (GRE) and/or the GRE

subject test in computer science. In addition, applicants must provide three letters of reference, at least one of which is from an academic source, and a letter outlining significant work experience and academic and career objectives.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A total of 30 credits (400-, 500-, 600-, or 800-level) is required for the Master of Science in Computer Science. Students are required to take the following courses:

Code	Title	Credits
Required Courses		
COMP 505	Theory of Computation	3
COMP 511	Design and Analysis of Algorithms	3
COMP 512	Advanced Operating Systems	3
COMP 519	Advanced Topics in Database Management Systems	3
Total Credits		12

Additionally, students are required to complete either a thesis or a paper according to one of the two options described below. Students who believe that they have completed a course substantially similar to one of the specific course requirements may apply to have their previous work evaluated for the purpose of exemption to that requirement. If the exemption is granted, another approved course shall be taken in place of that required course. The remaining 18 credits must be completed according to one of the following options:

Thesis Option

Research into a specific computer science problem, development of a scholarly written paper, and an oral defense. This option requires:

Code	Title	Credits
COMP 600	Thesis Research	6
3 credits from approved 500-level electives in computer science, mathematics, engineering, and information systems courses		3
9 credits from approved 400- and 500-level electives in computer science, mathematics, engineering, and information systems courses		9
Total Credits		18

Paper Option

In-depth study of specific computer science problems, development of a written paper or project, and an oral defense. This option requires:

Code	Title	Credits
COMP 594	Master's Studies	3
9 credits from approved 500-level electives in computer science, mathematics, engineering, and information systems courses		9
6 credits from approved 400- and 500-level electives in computer science, mathematics, engineering, and information systems courses		6
Total Credits		18

A maximum of 9 transfer credits will be allowed for course work completed as a graduate student at another institution, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://>

gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/).

Integrated Undergrad-Grad Programs

Integrated B.S. in Computer Science and M.S. in Computer Science

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Computer Science with the M.S. in Computer Science offered at the following campuses:

Undergraduate Degree

- Abington
- Harrisburg

Graduate Degree

- Harrisburg

The graduate portion of this IUG is currently offered as face-to-face residential instruction. While the undergraduate curriculum for this IUG may be completed at multiple campuses, the ease and feasibility of completing the integrated program may be heavily dependent upon the location of the graduate instruction. Please discuss the feasibility of completing the IUG with a representative for the graduate program before beginning the application process.

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The Computer Science program offers a limited number of academically superior Bachelor of Science candidates the opportunity to enroll in an integrated, continuous program of study leading to both the Bachelor of Science in Computer Science and the Master of Science in Computer Science. The ability to coordinate as well as concurrently pursue the two degree programs enables the student to earn the two degrees in five years.

Students in the IUG program must satisfy the degree requirements for both Bachelor of Science and Master of Science degrees. However, the total course load is reduced due to the maximum of 12 credits that can count towards both degrees.

The first two years of the IUG program are identical to the first two years of the Bachelor of Science program. The third and fourth years of the IUG program differ from those of the Bachelor of Science program due to the courses that count toward the Master of Science degree requirements. Student performance will be monitored on an on-going basis. In addition, a formal evaluation of student academic performance will be performed when the student has completed 100 to 105 credits, which is at the end of the first semester of the fourth undergraduate year for a typical student in the program. Students who have not maintained a 3.0 GPA in their Math and Computer Science courses will be put on probationary status with respect to the IUG program. Their ability to continue in the IUG program will be based on their academic performance in the last semester of their fourth undergraduate year.

As part of the review in the fourth undergraduate year, students will be advised about the paper option and thesis option in the graduate program. Students intending to pursue the thesis option would be advised to do so only if they have been doing very well in the program and are in no danger of not being able to continue into the fifth year.

A minimum grade point average of 3.0 must be earned in all math and computer science course work that is applied toward the graduate degree. This includes any courses that count toward both the undergraduate and graduate degrees, as well as all courses taken during the fifth year.

Students who successfully complete the courses listed in the recommended schedule will satisfy the requirements for the Bachelor of Science degree by the end of their fourth year.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

To initiate the application process, students must submit an Integrated Undergraduate-Graduate (IUG) Degree in Computer Science Application Form, a transcript, and a faculty recommendation, in addition to applying for admission to the Graduate School (<http://gradschool.psu.edu/prospective-students/how-to-apply/>).

Students must apply to the program via the Graduate School application for admission (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet all the admission requirements of the Graduate School and the Computer Science graduate program for the Master of Science degree, listed on the Admission Requirements tab. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.

In consultation with an adviser, students must prepare a plan of study appropriate to this integrated program, and must present their plan of study to the head of the graduate program or the appropriate committee overseeing the integrated program prior to being admitted to the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.

For consideration for acceptance into the program, students must have completed and earned a minimum grade point average of 3.0 in the following Computer Science and Mathematics courses:

Code	Title	Credits
MATH 140	Calculus With Analytic Geometry I	4
MATH 141	Calculus with Analytic Geometry II	4
MATH 220	Matrices	2-3
CMPSC 121	Introduction to Programming Techniques	3
or CMPSC 131	Programming and Computation I: Fundamentals	
CMPSC 122	Intermediate Programming	3
or CMPSC 132	Programming and Computation II: Data Structures	
CMPSC 360	Discrete Mathematics for Computer Science	3

Student applications will be evaluated based on their overall academic performance, in addition to the above requirements. In all cases, admission to the program will be at the discretion of the Graduate Admissions Committee in Computer Science.

Degree Requirements

Students must fulfill all degree requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Science in Computer Science are listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>). Degree requirements for the Master of Science in Computer Science are listed on the Degree Requirements tab. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.S. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted credits must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Computer Science (COMP) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/comp/>)

Learning Outcomes

1. **KNOW:** Graduates will be able to demonstrate mastery of core principles in Computer Science.
2. **THINK:** Graduates will demonstrate analytical and critical thinking within the practice of computer science and, where appropriate, across disciplines.
3. **APPLY/CREATE:** Graduates will be able to critically and creatively conceptualize, evaluate, formulate, and solve computing problems, including, where appropriate, in the process of creating new knowledge in the discipline of computer science.
4. **COMMUNICATE:** Graduates will be able to effectively communicate, to diverse audiences, solutions to complex problems.
5. **PROFESSIONAL PRACTICE:** Graduates will be able to demonstrate an understanding of professional and ethical responsibility and conduct themselves accordingly.

Contact

Campus	Harrisburg
Graduate Program Head	Vahid Motevalli
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Sukmoon Chang
Program Contact	Jamie L Bell W255 Olmsted 777 West Harrisburg Pike Middletown PA 17057 jlb8348@psu.edu (717) 948-6081
Program Website	View (https://harrisburg.psu.edu/science-engineering-technology/computer-science-and-mathematics/master-science-computer-science/)

Computer Science and Engineering

Graduate Program Head	Chita Das
Program Code	CSE
Campus(es)	University Park (Ph.D., M.S., M.Eng.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Master of Engineering (M.Eng.) Dual-Title Ph.D., M.S., and M.Eng. in Computer Science and Engineering and Operations Research
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=CSE)

The department offers courses and is prepared to direct research in a variety of subfields of computer science and engineering, including VLSI, computer architecture, parallel/distributed processors and processing, multiprocessors, interconnection networks, pattern recognition and image processing, performance evaluation, reliability, fault tolerance, theory of computation, computer systems, numerical analysis and optimization, programming methodology, and analysis of algorithms. Research and instruction are supported by extensive computing facilities within the University's Information Technology Services and by the computer laboratories operated by the department.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

All applicants must provide a statement of purpose, resume/CV, 3 letters of recommendation as well as official copies of transcripts, degree/study certificates and/or diplomas, as appropriate. The Graduate Record Examinations (GRE) Aptitude Test (verbal, quantitative, and analytical) is required for all M.S. and M.Eng. applications. GRE scores are no longer required for doctoral applicants. Please review the CSE Graduate Admissions (<https://www.eecs.psu.edu/students/graduate/EECS-How-to-apply-CSE.aspx>) website for additional details.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

For score reporting for TOEFL, the institution code is 2660.

International students seeking a Teaching Assistantship in Computer Science and Engineering will be required pass their AECOPT (<https://aplng.la.psu.edu/programs/about-the-aecopt/>) exam before being appointed as a Teaching Assistant.

Degree Requirements

Master of Engineering (M.Eng.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

A minimum of 30 credits at the 400, 500, or 800 level is required, with a minimum of 18 credits at the 500 or 800 level, and at least 6 credits at the 500 level.

Code	Title	Credits
Fall Semester		
CMPSC 465	Data Structures and Algorithms	3
6 credits of the following:		6
CMPSC 443	Introduction to Computer and Network Security & CMPSC 431 and Database Management Systems	
CMPEN 431	Introduction to Computer Architecture & CMPEN 472 and Microprocessors and Embedded Systems	
3 credits of the following:		3
CSE 500 - CSE 589		
CSE 597	Special Topics	
Spring Semester		
12 credits of the following:		12
CSE 500 - CSE 589		
CSE 597	Special Topics	
Summer Semester		
CSE 820	Software & Hardware Project Management	3
CSE 594	Research Topics	3
Total Credits		30

The culminating experience for the program is a master's paper completed while the student is enrolled in CSE 594.

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A minimum of 31 credits at the 400, 500, 600, or 800 level is required, with at least 18 credits at the 500 and 600 level, combined. Students may choose to complete a thesis or a scholarly paper. Students choosing to complete a thesis must complete at least 6 credits in thesis research (600 or 610). Students choosing to complete a scholarly paper must complete at least 18 credits in 500-level courses.

Code	Title	Credits
Required Courses		
15-18 credits of CSE courses with at least 15 credits of 500-level courses including any taken from the 9 credit breadth areas (thesis option); at least 18 credits of 500-level courses including any taken from the 9 credit breadth areas (non-thesis option); at most 9 credits of 400-level courses including any taken from the list below.		15-18
9 credits with one course each in the following three breadth areas: algorithms (CMPSC 465 or CSE 565), operating systems (CMPSC 473 or CSE 511), and computer architecture (CMPEN 431 or CSE 530).		9
CMPSC 465	Data Structures and Algorithms	
or CSE 565	Algorithm Design and Analysis	

CMPSC 473	Operating Systems Design & Construction	
or CSE 511	Operating Systems Design	
CMPEN 431	Introduction to Computer Architecture	
or CSE 530	Fundamentals of Computer Architecture	
CSE 590	Colloquium	1
Culminating Experience		
CSE 600	Thesis Research (Thesis)	6
or CSE 610	Thesis Research Off-Campus	
CSE 594	Research Topics (Scholarly Paper)	3
Total Credits		31

Students who choose to complete a thesis must pass a thesis defense. The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School. If the student completes a scholarly paper, the paper must be accepted by the supervising faculty member(s) and the head of the graduate program. The scholarly paper is completed while the student is enrolled in CSE 594.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Students applying for and gaining admittance to the Ph.D. program will not be permitted to switch to the master's program at a later date, except under extenuating circumstances, at the discretion of the program.

To qualify for a Ph.D. degree, students who do not have an M.S. degree in Computer Science or Computer Engineering must take a minimum of 33 credits, including:

Code	Title	Credits
Required Courses		
6 credits of the following:		6
CSE 565	Algorithm Design and Analysis	
CSE 511	Operating Systems Design	
CSE 530	Fundamentals of Computer Architecture	
15 credits of CSE courses (excluding CSE 596 and CSE 598)		15
9 credits of 400-, 500-, or 800-level courses in CSE/EE/MATH/STAT, or 500- or 800-level IST courses (which may include up to 3 credits of CSE 596)		9
CSE 590	Colloquium	2
CSE 591	Research Experience in Computer Science and Engineering	1
Total Credits		33

Students admitted to the Ph.D. program with an M.S. degree in Computer Science or Computer Engineering must take a minimum of 21 credits, including:

Code	Title	Credits
Required Courses		
6 credits of the following:		6
CSE 565	Algorithm Design and Analysis	
CSE 511	Operating Systems Design	
CSE 530	Fundamentals of Computer Architecture	
9 credits of CSE courses (excluding CSE 596 and CSE 598)		9

3 credits of 400-, 500-, or 800-level courses in CSE/EE/MATH/STAT, or 500- or 800-level IST courses (which may include up to 3 credits of CSE 596)	3
CSE 590 Colloquium	2
CSE 591 Research Experience in Computer Science and Engineering	1
Total Credits	21

A student must pass the Ph.D. qualifying examination by the third regular semester after entering the program. After completion of most of the course work and meeting the English competency requirement, students must pass the Ph.D. comprehensive examination.

A dissertation must be completed under the direction of the Ph.D. committee and the results must be successfully defended in the final oral examination. To earn the Ph.D. degree, doctoral candidates must write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Titles

Dual-Title M.Eng., M.S., and Ph.D. in Computer Science and Engineering and Operations Research

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admissions Requirements

Students must apply and be admitted to the graduate program in Computer Science and Engineering and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Operations Research dual-title program. Refer to the Admission Requirements section of the Operations Research Bulletin page. (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>) Doctoral students must be admitted into the dual-title degree program in Operations Research prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Computer Science and Engineering, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual-title in Operations Research, listed on the Operations Research Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Computer Science and Engineering and must include at least one Graduate Faculty member from the Operations Research program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Computer Science and Engineering and Operations Research. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/>

[gcac/gcac-600/phd-dissertation-committee-formation/](http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/)), the Ph.D. committee of a Computer Science and Engineering and Operations Research dual-title Ph.D. student must include at least one member of the Operations Research Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Operations Research, the member of the committee representing Operations Research must be appointed as co-chair. The Operations Research representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Computer Science and Engineering and Operations Research. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Computer Science and Engineering (CSE) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/cse/>)

Learning Outcomes

Master of Engineering (M.Eng.)

1. Graduates will be able to demonstrate understanding of advanced core principles and methods from selected sub-fields of Computer Science and Engineering at a depth consistent with their course of study.
2. Graduates will be able to apply their knowledge of selected sub-fields of Computer Science and Engineering to formulate and solve engineering problems.
3. Graduates will be able to analyze and synthesize knowledge within the field of Computer Science and Engineering to address a complex problem of practical relevance.
4. Graduates will be able to demonstrate proficiency in written communication appropriate to their discipline.
5. Graduates will be able to demonstrate an understanding of and a commitment to, academic integrity and the standards for professional practice within Computer Science and Engineering.

Master of Science (M.S.)

1. Graduates will be able to demonstrate understanding of advanced core principles and methods from selected sub-fields of Computer Science and Engineering at a depth consistent with their course of study.
2. Graduates will be able to apply their knowledge of selected sub-fields of Computer Science and Engineering to formulate and solve engineering problems.
3. Graduates will be able to analyze and synthesize knowledge within the field of Computer Science and Engineering to extend existing knowledge through a research experience or a course-based culminating experience.
4. Graduates will be able to demonstrate proficiency in oral and written communication appropriate to their discipline.
5. Graduates will be able to demonstrate an understanding of, and a commitment to, the standards of scholarship and research integrity within Computer Science and Engineering.

Doctor of Philosophy (Ph.D.)

1. Graduates will be able to demonstrate an understanding of advanced core principles and methods as well as modern research findings from selected sub-fields of Computer Science and Engineering (CSE) at a depth appropriate for a Ph.D. candidate.
2. Graduates will be able to apply their knowledge of selected sub-fields of Computer Science and Engineering in formulating and executing a research plan.
3. Graduates will be able to demonstrate the ability to analyze and synthesize appropriate literature to critically review their work in the context of the literature, and to formulate and defend conclusions based on their research that represent new scholarly contributions.
4. Graduates will be able to demonstrate high levels of proficiency in oral and written communication.
5. Graduates will be able to demonstrate an understanding of and a commitment to, the standards for scholarship and research integrity.

Contact

Campus	University Park
Graduate Program Head	Chitaranjan Das
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	John Morgan Sampson
Program Contact	Erin Ammerman Graduate Admissions W209 Westgate Building University Park PA 16802 exa7@psu.edu (814) 863-1242
Program Website	View (http://www.cse.psu.edu/prospective/graduate/)

Corporate Innovation and Entrepreneurship

Graduate Program Head	Brian Cameron
Program Code	CIENT
Campus(es)	World Campus (M.Mgt.)
Degrees Conferred	Master of Management (M.Mgt.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=CIENT)

The Master of Management in Corporate Innovation and Entrepreneurship program prepares graduates to stand out in the workplace and/or a competitive job market by studying at a highly-reputed business school with some of the world's leading academic thinkers and industry experts. This program provides students with the business, leadership, and organizational skills needed to lead and facilitate corporate innovation in its many forms, new venture creation, effective change management, and entrepreneurial business planning. Students will acquire the skills needed to succeed in today's dynamic work environments, gain a firm understanding of business and technology issues and problems, and be prepared to become leaders of innovation. The two primary concentration areas provided through this program, involving business and engineering, will give students the opportunity to develop competencies tailored to their needs in a corporate setting. Additional secondary academic concentrations are offered to allow students to explore focused business domains in-depth that relate directly to innovation and entrepreneurship. The program is taught by the same world-class professors who teach our M.B.A., executive education, and engineering students. A solid foundation in innovation, entrepreneurship, strategy, decision analysis, management, organizational behavior, accounting, marketing, business planning, and finance will make graduates more attractive to hiring managers and enable them to advance more rapidly into management and leadership positions. These learning outcomes are achieved by a combination of online learning experiences, lectures by faculty, invited guest lecturers, reading of key literature, individual and team projects, and a capstone experience that synthesizes and integrates past learning.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to

Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

A completed online Graduate School Application for Admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>) is required, including:

- About three years of post-undergraduate, professional work experience. Managerial or team leadership experience is preferred but not required. Less experienced candidates will be considered at the discretion of the program director.
- Statement of purpose: a 2-3 page essay articulating career and educational goals
- Résumé reflecting relevant experience
- Official transcripts from all post-secondary institutions attended (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/new-applicants/requirements-for-graduate-admission/>)
- Additional information may be requested by the program.

GMAT and/or GRE scores will not be required for admission. Accordingly, these scores will not be accepted.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Exceptions to GCAC-305 (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) will be considered by the program. Exceptions may or may not be granted by the Graduate School.

Degree Requirements

Master of Management (M.Mgt.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

A minimum of 33 credits is required for the Master of Management in Corporate Innovation and Entrepreneurship program. At least 18 credits must be at the 500 or 800 level. In addition to the 15 required core credits listed below, students are required to complete 9 elective credits in a Primary Concentration area, and 9 elective credits in a Secondary Concentration. The list of courses that will fulfill the Primary and Secondary Concentration areas is maintained by the graduate program office.

Code	Title	Credits
Required Courses		
MBADM 850	Corporate Innovation and Entrepreneurship	3
Select three of the following course courses:		9
ENTR 502	Business Modeling and New Venture Creation	

ENTR 810	Emerging Trends, Technology, and Corporate Innovation	
ENTR 820	Corporate Innovation Strategies and Entrepreneurial Methods	
MGMT 870	Entrepreneurial Finance and Venture Funding	
<i>Primary Concentration</i> ¹		9
<i>Secondary Concentration</i> ¹		9
Culminating Experience		
ENTR 830	Entrepreneurial Business Planning and Strategy Execution	3
Total Credits		33

¹ The list of courses that will fulfill the Primary and Secondary Concentration areas is maintained by the graduate program office.

The capstone course, ENTR 830, serves a critical role in helping students synthesize and integrate past learning in the MGMT program, providing additional education on how to write a form business case or business plan, implement plans and new venture strategies, and scale new ventures to become mature business organizations. Additionally, this class requires students to write a robust, in-depth research paper on a topic related to innovation and entrepreneurship.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up

deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Entrepreneurship (ENTR) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/entr/>)

Learning Outcomes

1. KNOW

- Graduates will be able to demonstrate competency in the underlying concepts, theory, and tools related to innovation and creativity.
- Graduates will understand the benefits and purpose of invention and innovation in multiple business domains.
- Graduates will be able understand and manage the issues, barriers, and enablers associated with launching a successful new venture.
- Graduates will be able to understand the best approaches new venture business planning and strategy implementation.
- Graduates will be able to understand the implications and best practices associate with protecting and managing intellectual property.

2. APPLY/CREATE

- Graduates will acquire the analytical and critical thinking skills needed to identify, analyze, generate, and evaluate alternative solutions to business problems.
- Graduates will be able to demonstrate competency in understanding how to perform product, service, technology, process, policy, and strategy innovation.
- Graduates will be able to demonstrate competency in analyzing, developing, and implementing new business models.
- Graduates will be able to demonstrate competency in how to make an organization more innovative leveraging business strategy and corporate culture.
- Graduates will be able to demonstrate competency in applying the principles of innovation to human resource policy, reward systems, business processes, marketing, and strategic decision making.
- Graduates will be able to demonstrate competency in understanding how to establish, develop, and manage innovative teams.
- Graduates will increase their skills in leadership, team building, interpersonal influence, and the management of innovation and change.

3. COMMUNICATE

- Graduates will be able to use their knowledge of different business disciplines to identify, analyze, and recommend solutions to complex business problems, blending functional expertise and multi-disciplinary perspectives.
- Graduates will be able to communicate and work effectively with others in an increasingly diverse workplace.

4. THINK

- Graduates will learn the techniques involved in thinking creatively, innovatively, and strategically.

5. PROFESSIONAL PRACTICE

- Graduates will be able to articulate and defend their ideas, concepts, and analyses, and recommended solutions to a variety of business audiences.
- Graduates will be able to demonstrate competency in the methods, practices, and activities associated with launching

a new venture or startup and turning it into a viable business initiative.

- Graduates will be able to demonstrate competency in the underlying concepts, theory, and tools of general business.

Contact

Campus	World Campus
Graduate Program Head	Brian Harold Cameron
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Shawn Clark
Program Contact	Michelle Kristen Rockower mkk114@psu.edu (814) 865-5290
Program Website	View (https://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-corporate-innovation-and-entrepreneurship-masters/overview/)

Counselor Education

Graduate Program Head	P. Karen Murphy
Program Code	CNED
Campus(es)	University Park (Ph.D., M.Ed.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Education (M.Ed.) Dual-Title Ph.D and M.Ed. in Counselor Education and Comparative and International Education
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=CNED)

Professional preparation is offered at the master's level (M.Ed.) with emphasis areas in career counseling, clinical mental health counseling, school counseling, and rehabilitation counseling.

The Ph.D. program prepares candidates for positions as counselor education faculty members.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Scores from the Graduate Record Examination (GRE) are required for admission to the Ph.D. program. GRE scores are not required for the M.Ed. program.

M.Ed. applications with a 3.0 junior/senior average (on a scale of 4.00) and with appropriate course backgrounds will be considered for admission. The best-qualified applicants will be accepted up to the number of spaces that are available for new students. Exceptions to the minimum 3.0 grade-point average may be made for students with special backgrounds, abilities, and interests.

Doctoral applicants must have completed a master's degree in counselor education prior to admission into the Ph.D. program. A master's degree is required for admission that must be comprised of a minimum of 48 credit hours that align with the standards of the Council for Accreditation of Counseling and Related Educational Programs (CACREP). All doctoral applicants should present at least a 3.33 average in all graduate study completed prior to admission.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

All candidates are expected to exhibit, in addition to academic competence, effectiveness in interpersonal relations and in both written and oral communication. They also must provide evidence in support of professional counseling activities and involvement in professional organizations. All degree options require students to participate in extensive practicum or fieldwork experience under supervision.

Master of Education (M.Ed.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The M.Ed. program includes 60 to 61 credits depending on the area of emphasis. This includes 36 credits of core requirements plus 24 to 25 credits depending on the area of emphasis. All courses must be taken at the 400 or 500 level.

Code	Title	Credits
Required Courses		
CNED 404	Group Procedures in Guidance and Counseling	3
CNED 500	Professional Counseling Orientation and Ethical Practice	3
CNED 501	Counseling Theory and Method	3
CNED 505	Foundations of Career Development and Counseling Information	3
CNED 506	Individual Counseling Procedures	3
CNED 507	Multicultural Counseling: Foundations	3
CNED 525	Applied Testing in Counseling	3
CNED 526	Research in Counselor Education	3
CNED 595A	Counseling Practicum	3
CNED 595E	School Counseling Internship and Seminar	6
	or CNED 595G Counseling Internship and Integrative Seminar	
Culminating Experience		
CNED 596	Individual Studies (Master's Paper)	3
Total Credits		36

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The Ph.D. program consists of a minimum of four academic years of graduate level preparation (including master's-level preparation), defined as eight semesters.

The Ph.D. program consists of a minimum of 96 credits including master-level preparation in counselor education. Ph.D. students must satisfy advanced degree requirements in the CACREP counselor education core areas (36 credits including 6 credit hours of CNED 595I doctoral internship), a specialty area of study (15 credits), and empirical foundations (15 credits). Students in the Ph.D. program are expected to complete a dissertation involving independent and original research. Students are expected to use theoretical models of counseling to investigate problems of importance to the field. The additional credits in the Ph.D. program incorporate advanced course work in research design, statistics, and counseling theory to prepare students for their subsequent roles as faculty members in counselor education programs.

Code	Title	Credits
Required Courses		
CNED 502	Advanced Counseling Theory and Method	3
CNED 554	Cross-Cultural Counseling	3
CNED 555	Career Counseling	3
CNED 580	Foundations: History and Trends in Counselor Education	3
CNED 581	Professional Issues in Counselor Education	3
CNED 582	Advanced Group Psychotherapy	3
CNED 589	Seminar on Counseling Supervision	3
CNED 595D	Supervision of Counselors	3
CNED 595I	Counselor Education Doctoral Internship	6
CNED 595P	Counselor Education Doctoral Counseling Practicum (3 credits per semester; two semesters [6 credits] are required)	6
<i>Specialty Area of Study</i>		<i>15</i>
<i>Empirical Foundations</i>		<i>15</i>
Total Credits		66

Qualifying Examination

All Ph.D. students are required to have a master's degree in counselor education prior to admission. After completion of 12 credits of doctoral study, which may allow the student to take the qualifying examination as early as the second semester in their doctoral program, Ph.D. students may take a qualifying examination. Given the requirement that doctoral students will have a master's degree in counselor education thereby demonstrating their ability to complete graduate work successfully, the nature of the qualifying examination will include a review of the following by the student's qualifying examination committee:

1. the student's professional resume,
2. a statement regarding the general direction of the student's research interests and possible areas of dissertation inquiry,
3. grades from completed graduate courses,
4. proposed course of study for subsequent semesters,
5. selected graduate papers written by the student, and
6. a statement regarding the student's professional goals.

In the qualifying examination, the student's qualifying examination committee determines the student's ability to continue in the program and to conduct doctoral research.

Comprehensive Examination

Ph.D. students are required to take a written and oral comprehensive examination once their course work is completed (or when they are in their final semester of required course work) and prior to the dissertation. The examination, prepared by the student's Ph.D. committee, covers all areas of the student's doctoral work. The comprehensive examination for Ph.D. students must include an assessment of the student's competence related to conducting independent and original research.

Ph.D. Committee Composition

The Ph.D. committee must meet all Graduate Council requirements (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>).

Doctoral Dissertation and Final Oral Examination

Ph.D. students should complete the writing of the dissertation and make revisions to the satisfaction of the committee chair, who is expected to ensure that the dissertation is in near final form before allowing the final oral examination (defense) to be scheduled. The student is responsible for arranging and scheduling a time so that all members of the committee can be present. The student must give each committee member a copy of the complete dissertation *two weeks before the final oral examination*. Students should not expect this to be the final version for submission to the Graduate School, as there are typically revisions after successful completion of the oral defense.

English Competence

Candidates for the Ph.D. program are required to demonstrate high-level competence in the use of English language, including reading, writing, and speaking. Counselor Education evaluates English language proficiency in several ways. Prior to admission all students are required to provide written goals statements and personal development statements that are evaluated by faculty as a portion of the application process. Additionally, international students must have either earned a master's degree in the United States or supply official minimum scores for the TOEFL. Once admitted to the program and prior to taking the qualifying examination, students are evaluated for their reading, writing, and speaking in class assignments and as a part of their first-year portfolio evaluation. When problems are identified, individual remediation programs are developed that utilize faculty and all appropriate University resources.

Dual-Titles

Dual-Title M.Ed. and Ph.D. in Counselor Education and Comparative and International Education

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admissions Requirements

Students must apply and be admitted to the graduate program in Counselor Education and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Comparative and International Education dual-title program. Refer to the Admission Requirements section of the Comparative and International Education Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/comparative-international-education/>). Doctoral students must be admitted into the dual-title degree program in Comparative and International Education

prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Counselor Education, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual-title in Comparative and International Education, listed on the Comparative and International Education Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/comparative-international-education/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Counselor Education and must include at least one Graduate Faculty member from the Comparative and International Education program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Counselor Education and Comparative and International Education. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Counselor Education and Comparative and International Education dual-title Ph.D. student must include at least one member of the Comparative and International Education Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Comparative and International Education, the member of the committee representing Comparative and International Education must be appointed as co-chair. The Comparative and International Education representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the Ph.D. dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their interest and education in Counselor Education and Comparative and International Education. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)

- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Counselor Education (CNE) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/cned/>)

Professional Licensure/Certification

Many U.S. states and territories require professional licensure/certification to be employed. If you plan to pursue employment in a licensed profession after completing this program, please visit the Professional Licensure/Certification Disclosures by State (<https://www.psu.edu/state-licensure-disclosures/>) interactive map.

Contact

Campus	University Park
Graduate Program Head	P Karen Murphy
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Elizabeth A Prosek
Program Contact	Madison Marie Woomer 125 CEDAR Building University Park PA 16802-3110 mmm7153@psu.edu (814) 865-7454
Program Website	View (https://ed.psu.edu/counselor-education-med/)

Criminal Justice

Graduate Program Head	L. Marvin Overby
Program Code	CRIMJ
Campus(es)	Harrisburg (M.A.)
Degrees Conferred	Master of Arts (M.A.) Integrated B.S. in Criminal Justice and M.A. in Criminal Justice
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=CRIMJ)

The program reflects the numerous complexities of the discipline. It provides academic leadership for students to work within corrections, institutionalized and non-institutionalized settings, victim services, adult and juvenile services, policing and law enforcement, private security, courts, and other human service organizations serving the clients of these institutions. It also helps develop research acumen for those students who may wish to consider doctoral studies.

Strong ties developed in state, local, and federal level law enforcement, corrections, drug treatment, victimization, and crime control policy organizations provide research and learning opportunities for interested students.

The degree may be earned by full or part-time study. Most courses will be offered in the evening, although some will be offered during the day or on weekends.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

- A completed Graduate School application for admission (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>) with the application fee.
- Official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>).
- Three letters of recommendation.
- A brief (two-page) statement of purpose or a writing sample.
- Minimum GPA of a 3.0 for the last 60 credits of undergraduate study. Satisfactory scores on the Graduate Record Examination (GRE), Graduate Management Admissions Test (GMAT), or Law School Admissions Test (LSAT) are required if the GPA is less than 3.0. *Note: All students who seek funding must take one of these standardized tests, preferably the GRE.*
- Some foundational course work may be required for those students who did not major in criminal justice as an undergraduate. This decision will be made by the MACJ Program Coordinator after a close review of the undergraduate transcript.
- In exceptional cases, the program may also approve admission by reason of special backgrounds, abilities, and interests.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students

(<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of Arts (M.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The thesis track requires 30 credits. Six of the credits (CRIMJ 600) will be for the thesis.

The master's paper track requires 30 credits. Three of these credits will be awarded for successful completion of a master's paper, for which a student will register for three credits of CRIMJ 594.

All credits must be at the 400, 500, 600, or 800 level, with a minimum of 18 credits at the 500 or 600 level. A minimum of 24 credits must be at the 500, 600, or 800 level.

A minimum grade-point average of a 3.0 must be earned for course work taken as a graduate student.

Students are required to take the following courses: CRIMJ 500, CRIMJ 501, CRIMJ 502, CRIMJ 503, and CRIMJ 504. Students must complete a 9 credit concentration. Students in the non-thesis track will also be required to complete an additional 3-credit elective. A list of courses required for each concentration and additional approved elective courses is maintained by the graduate program office.

Code	Title	Credits
Required Courses		
CRIMJ 500	Advanced Criminological Theory	3
CRIMJ 501	Advanced Research Methods for Criminal Justice	3
CRIMJ 502	Public Policy and the Criminal Justice System	3
CRIMJ 503	Advanced Statistics in Criminal Justice	3
CRIMJ 504	Criminal Justice Organization and Management	3
<i>Concentration</i> ¹		9
Culminating Experience		6
Thesis Track: 6 credits of CRIMJ 600		
Master's Paper Track: 3 credits of CRIMJ 594 and a 3-credit elective ¹		
Total Credits		30

¹ A list of courses required for each concentration and additional approved elective courses is maintained by the graduate program office.

Students who believe they have completed a course substantially similar to one of the specific course requirements may apply to have their previous work evaluated for the purposes of exemption to that requirement. If approved, another course will be taken in place of that requirement.

Credits earned at other institutions but not used to earn a degree may be applied toward the requirements for a graduate degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>).

Integrated Undergrad-Grad Programs

Integrated B.S. in Criminal Justice and M.A. in Criminal Justice

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Criminal Justice with the M.A. in Criminal Justice offered at the following campuses:

Undergraduate Degree

- Harrisburg
- World Campus

Graduate Degree

- Harrisburg

The graduate portion of this IUG is currently offered as face-to-face residential instruction. While the undergraduate curriculum for this IUG may be completed at multiple campuses, the ease and feasibility of completing the integrated program may be heavily dependent upon the location of the graduate instruction. Please discuss the feasibility of completing the IUG with a representative for the graduate program before beginning the application process.

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The Criminal Justice Program offers an integrated B.S./M.A. program that is designed to allow academically superior baccalaureate students enrolled in the Criminal Justice major to obtain both the B.S. and the M.A. degrees in Criminal Justice within five years of study. The first two years of undergraduate coursework typically include the University General Education requirements and lower-level courses. In the third year, students typically take upper-division coursework in Criminal Justice and define areas of interest. The fourth year involves graduate-level Criminal Justice coursework including required courses in Criminal Justice Theory and Policy (CRIMJ 500; CRIMJ 502). The fifth and final year of the program typically consists of graduate course work in Criminal Justice including Advanced Research Methods and Statistics in Criminal Justice (CRIMJ 501; CRIMJ 503) and identification of an original research project that will culminate in the completion of a thesis (CRIMJ 600) or master's paper (CRIMJ 594).

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The number of openings in the integrated B.S./M.A. program is limited. Admission is selective based on specific criteria and the unqualified recommendation of faculty. Applicants to the integrated program:

1. Must be enrolled in the B.S. program in Criminal Justice and meet the admission requirements of the Criminal Justice M.A. program at Harrisburg.

2. Must apply to the program via the Graduate School application for admission (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet the admission requirements of the Graduate School.
3. Must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.
4. Must submit transcript(s) of undergraduate work taken outside of Penn State, recommendations from two faculty members, writing sample, and statement of goals.
5. Must have an overall GPA at or above 3.0 (on a 4.0 scale) in undergraduate coursework and a GPA at or above 3.25 in all coursework completed for their major.
6. Must present a plan of study approved by the student's adviser in the application process. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.S. in Criminal Justice are listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.A. degree are listed in the Degree Requirements section. Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
CRIMJ 450W	Senior Seminar	3
CRIMJ 465	Ethics in Criminal Justice	3
CRIMJ 500	Advanced Criminological Theory	3
CRIMJ 501	Advanced Research Methods for Criminal Justice	3
CRIMJ 502	Public Policy and the Criminal Justice System	3
CRIMJ 504	Criminal Justice Organization and Management	3

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.A. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree

Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Criminal Justice (CRIMJ) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/crimj/>)

Contact

Campus Harrisburg
Graduate Program Head L. Marvin Overby
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC) Jennifer Catherine Gibbs

Program Contact Jaime Vargas
 School of Public Affairs
 777 West Harrisburg Pike, 160W
 Olmsted Bldg.
 Middletown PA 17057
 jlh379@psu.edu
 (717) 948-6648

Program Website View (<https://harrisburg.psu.edu/public-affairs/criminal-justice/master-arts-criminal-justice/>)

Criminal Justice Policy and Administration

Graduate Program Head	Jennifer Gibbs
Program Code	CJPA
Campus(es)	World Campus (M.P.S.)
Degrees Conferred	Master of Professional Studies (M.P.S.) Integrated B.A./B.S. in Criminology and M.P.S. in Criminal Justice Policy and Administration
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=CJPA)

The M.P.S. in CJPA degree program capitalizes on Penn State's strengths as a premier research institution to provide an advanced professional degree in criminal justice policy and administration. Combining theory and applied research, this degree allows professionals and students entering the work force to gain graduate level expertise in this growing, applied field of study. The degree caters to professionals in criminal justice (broadly, policing, courts, corrections, probation/parole, and treatment), government, administration, and offender or victim services.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Educational Background

Students who do not have an undergraduate GPA of at least 3.0 will be considered on a case-by-case basis depending on the quality of their overall application. Work experience will be considered for applicants who have more than two years of experience in a related field.

Core Application Packet

- Completed official online Graduate School application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) and payment of a nonrefundable application fee.
- Statement of purpose: a 2-3 page essay articulating career and educational goals that demonstrate the student's written communication skills and describes their background with basic statistics education and/or usage.
- A current curriculum vitae (vita) or résumé.
- Three letters of recommendation that attest to the student's readiness for graduate study. Letters must be submitted through the online application system. Within the online application you will be asked to enter the names and email addresses of three individuals who will be providing your recommendation. Those individuals will receive a note via email asking them to complete a brief form that will serve as your recommendation. Please inform all recommenders they must submit the form in order for your application to be complete.
- Official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>).

Degree Requirements

Master of Professional Studies (M.P.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The 30-credit program of study emphasizes social science perspectives to the study of criminal justice. The degree consists of core courses (18 credits) and allows students to choose from among several electives.

Total required credits for the M.P.S.: 30 credits. At least 18 credits must be completed at the 500 level or 800 level, with at least 6 credits at the 500 level.

Code	Title	Credits
Required Courses		
CJPA 501	Criminal Justice Institutions	3
CJPA 502	Theories of Crime	3
CJPA 803	Applied Research Methods	3
CRIMJ 503	Advanced Statistics in Criminal Justice	3
CJPA 820	Criminal Procedure	3
CJPA 865	Criminal Justice Ethics in a Diverse Society	3
Electives		
Select 9 elective credits ¹		9
Culminating Experience		
CJPA 808	Capstone Project in Criminal Justice Policy and Administration	3
Total Credits		30

- ¹ Students will have the opportunity to tailor their program of study to their interests by choosing from a list of elective courses. The elective courses will be chosen in consultation with the student's advisor. The list of approved elective courses is maintained by the graduate program office.

The capstone course provides students with an opportunity to apply their knowledge from their courses to a project. The choice of project topic and exact form will be mutually determined by faculty mentors and the student. For example, the capstone experience could be an academic research project, an evidence-based policy evaluation, or the development of a program. The student will work with a faculty mentor/adviser on a capstone project that will be written up as a capstone report. Students are expected to utilize theories, literature, and methods acquired during other courses in the M.P.S. in Criminal Justice Policy and Administration. The report will be formally presented to peers in the M.P.S. and faculty members at the end of the semester. The capstone report must be approved by the faculty mentor/adviser as meeting the course requirements.

Course Substitutions

Substitutions for the above prescribed courses, either with resident-education courses, alternate online courses, or courses from other institutions, will be considered on a case-by-case basis subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/>).

transfer-credit/). Course substitutions must be petitioned and approved in advance by the Chair/Co-Chair, with input from the student's adviser.

Integrated Undergrad-Grad Programs

Integrated B.A./ B.S. in Criminology and M.P.S. in Criminal Justice Policy and Administration

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.A./B.S. in Criminology with the M.P.S. in Criminal Justice and Policy Administration offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- World Campus

The graduate portion of this IUG is currently offered as face-to-face residential instruction. While the undergraduate curriculum for this IUG may be completed at multiple campuses, the ease and feasibility of completing the integrated program may be heavily dependent upon the location of the graduate instruction. Please discuss the feasibility of completing the IUG with a representative for the graduate program before beginning the application process.

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

This Integrated Undergraduate/Graduate program (IUG) provides an opportunity for academically strong students to complete a Bachelor of Arts (B.A.) or Bachelor of Science (B.S.) degree in Criminology and a Master of Professional Studies (M.P.S.) degree in Criminal Justice Policy and Administration (CJPA) in approximately five years of study.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.

Admission is selective based on criteria established by the leadership of the CJPA MPS program and Criminology major. Though exceptions are possible, student applicants will generally have a minimum overall GPA of 3.2 (on a 4.0 scale). Students are admitted to the IUG based on good progress in their major, success in statistics, data analysis, and research methods courses (evidenced by letter grades of B+ or greater in the required Criminology courses of CRIM 249 and CRIM 250W), faculty recommendations (two letters), GPA and a 2-page statement of purpose explaining why they want to participate in this program and why they are qualified to do so. Concurrent with application to the IUG program,

students must apply to the program via the Graduate School application for admission and must meet all the admission requirements of the Graduate School and the CJPA graduate program for the M.P.S. degree.

Advising

Students admitted to the program are advised by co-advisers, one from each participating unit. Each student will have an adviser in CJPA who will work with the student and an adviser in Criminology to ensure successful completion of the degree. The co-advisers will help the student prepare the initial plan of study, and assist in making changes and approving the student's plan of study each semester during the advising period.

Sequence of Courses

During the first three years of study students will follow the basic course sequence provided for by the existing B.A. or B.S. plan in Criminology. In the fourth year of study they will take three courses that will count both toward the B.A. or B.S. in Criminology and count for the CJPA M.P.S. three elective courses. These courses will be chosen from among the list of CJPA electives.

Plan of Study

Prior to being admitted to the program, and in consultation with their Criminology and CJPA advisers, students must prepare a detailed plan of study for years 4 and 5 of the program. The plan is periodically reviewed by the student and advisers, and revised as necessary. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree.

Degree Requirements

Students must fulfill all degree requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Arts and Bachelor of Science in Criminology are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). Degree requirements for the Master of Professional Studies in Criminal Justice Policy and Administration degree are listed on the Degree Requirements tab. If students accepted into the IUG program are unable to complete the M.S. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
CRIM 430	American Correctional System	3
CRIM 432	Crime and the American Court System	3
CRIM 433	Sentencing	3
CRIM 467	Law and Society	3
CJPA 501	Criminal Justice Institutions	3

CJPA 502	Theories of Crime	3
CJPA 803	Applied Research Methods	3
CJPA 820	Criminal Procedure	3
CJPA 865	Criminal Justice Ethics in a Diverse Society	3
CRIMJ 503	Advanced Statistics in Criminal Justice	3

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Criminal Justice Policy and Administration (CJPA) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/cjpa/>)

Learning Outcomes

Upon graduation from this program, students should be able to:

- Describe and summarize crime rates, trends, and patterns, and apply foundational knowledge of criminological theories devoted to explaining crime. This objective coincides with goals # 1, # 2, and # 3 of the Graduate School, by teaching students core disciplinary knowledge, and requiring its application and communication.
- Describe organizational structures, processes, and challenges of criminal justice institutions, and analyze past and current criminal justice policies and evidence-based practices. This objective coincides with goals # 1, # 2, and # 3 of the Graduate School, by

teaching students core disciplinary knowledge, and requiring its application and communication.

- Apply the foundations of contemporary ethical practices and effective leadership in the criminal justice profession. This objective coincides with goal #5 above of the Graduate School by requiring students to learn and engage in ethical research and practice in criminal justice.
- Employ advanced knowledge in social science research and applied statistical methods, specifically focused on criminal justice issues. This objective coincides with goals # 2 and # 4 of the Graduate School, by teaching students social science research methods, and requiring their use in studying criminal justice topics.
- Demonstrate advanced knowledge of criminal procedure. This objective coincides with goal # 1 of the Graduate School, in that it emphasizes the learning of core disciplinary knowledge in criminal justice.

Contact

Campus	World Campus
Graduate Program Head	Jennifer Catherine Gibbs
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Ahmet Guler

Program Contact	Ahmet Guler School of Public Affairs 777 W. Harrisburg Pike Middletown PA 17057 axg1373@psu.edu (814) 865-2527
Program Website	View (https://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-criminal-justice-policy-and-administration-masters/overview/)

Criminology

Graduate Program Head	Michelle Frisco
Program Code	CRIM
Campus(es)	University Park (Ph.D., M.A.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Arts (M.A.) Dual-Title Ph.D. in Criminology and Social Data Analytics
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=CRIM)

The graduate program in Criminology is for students seeking the Ph.D. degree. Students may either enter the program with an M.A. degree or earn that degree en route to the Ph.D. program. The program offers an advanced education on various aspects of criminology to persons interested in research careers in academia and public service.

The graduate program emphasizes theory and research on crime and justice, research and statistical methodology, and substantive knowledge about crime and its control.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Applications from students with either the B.A. or M.A. degree will be accepted through early January for admission in the fall of the following academic year. Selection is based on:

- official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>),
- three letters of recommendation from persons familiar with the applicant's academic performance,
- a statement of goals,
- a sample of written work such as a term paper,
- and Graduate Record Examinations (GRE) verbal, quantitative, and writing scores.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of Arts (M.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Students entering the program with the B.A. degree will first earn the M.A. degree. Thirty-eight credits of course work at the 400, 500, 600, or 800 level, with a minimum of 18 credits at the 500 and 600 level, combined, and a master's thesis, including 6 credits of thesis research, are required for the M.A. The course work includes:

- an introduction to graduate studies seminar,
- a sequence of methods and statistics courses;
- a sequence of two criminological theory courses;
- a course in the organization and criminal justice system;
- a teaching seminar
- and additional 500-level substantive criminology courses selected in consultation with a student's faculty committee.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

For the Ph.D., 30 credits beyond the M.A. are required, no more than three of which may be for Individual Studies. All Ph.D. candidates must have completed all courses required for the M.A. degree or their equivalent. The 30 credits beyond the M.A. must include 6 hours of Criminology seminars and 12 hours of elective seminars, all of which should be

selected in consultation with the Ph.D. committee. Seminar requirements are not fulfilled by Individual Studies credits.

Qualifying Examination

A qualifying exam is required of all students seeking the Ph.D., after a master's degree has been earned. Students admitted with a master's degree will stand for this exam in the second semester of full-time study.

Language Requirement

The program in Criminology has no formal foreign language or communication requirement.

Ph.D. Committee Composition

The student's Ph.D. studies are conducted under the supervision of a Ph.D. committee that must meet all Graduate Council requirements (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>). At least two members of the Ph.D. committee must be Criminology tenure-line faculty and one must be from outside the Criminology Program and Sociology Department and must represent a field outside the candidate's major field of study. One Criminology tenure-line faculty member is designated chair of the Ph.D. committee; ordinarily this person also serves as general adviser and director of the dissertation.

Comprehensive Examination

After completing all course work, doctoral students must pass a comprehensive examination that will be administered by the student's Ph.D. committee. At the discretion of the committee, examination content will include material on:

1. general criminological theory,
2. criminal justice/law,
3. research methods/statistics, and
4. the student's area of specialization.

Dissertation and Dissertation Defense

In order to earn the Ph.D., students are required to write and orally defend a dissertation on a topic that reflects their original research and education.

Dual-Titles

Dual-Title Ph.D. in Criminology and Social Data Analytics

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Criminology doctoral students seeking to attain and be identified with an interdisciplinary array of tools, techniques, and methodologies for social data analytics, while maintaining a close association with criminology, may apply to pursue a dual-title Ph.D. in Criminology and Social Data Analytics.

Social data analytics is the integration of social scientific, computational, informational, statistical, and visual analytic approaches to the analysis of large or complex data that arise from human interaction. The dual-title Ph.D. program provides additional training with the aim of providing criminologists with the skills required to expand the field of social data analytics, creatively answer important criminological questions, and communicate effectively with both academic and nonacademic audiences.

ADMISSION REQUIREMENTS

Students must apply and be admitted to the graduate program in Criminology and the Graduate School before they can apply for admission to the dual-title degree program. After admission to the Criminology program, students must apply for admission to and meet the admissions requirements of the Social Data Analytics dual-title program. Refer to the Admission Requirements section of the Social Data Analytics Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/social-data-analytics/#admissionrequirements>). Applicants interested in the dual-title degree program may note their interest in the program on their applications to Criminology and include remarks in their personal statements, in which they address the ways in which their research and professional goals in sociology reflect related interests in Social Data Analytics-related research.

DEGREE REQUIREMENTS

To qualify for the dual-title degree, students must satisfy the degree requirements for the Ph.D. in Criminology, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual-title Social Data Analytics, listed on the Social Data Analytics Bulletin page. This requirement involves 18 credits, including: SoDA 501 (3 credits), SoDA 502 (3 credits), and 12 or more elective credits in Social Data Analytics from a list of courses maintained by the Social Data Analytics Committee. There is no formal maximum number of credits from the primary Criminology degree that can be double-counted toward the SoDA degree, though Ph.D. committees may limit the number of double-counted credits. For those meeting the SoDA elective requirement with the minimum of 12 credits, the outside-program minimum effectively limits the number of primary degree credits that count toward SoDA at 6.

The qualifying examination in Criminology satisfies the qualifying exam requirement for the dual-title degree program in Social Data Analytics. In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Social Data Analytics dual-title doctoral degree student must include at least one member of the Social Data Analytics Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Social Data Analytics, the member of the committee representing Social Data Analytics must be appointed as co-chair. The Social Data Analytics representative on the student's Ph.D. committee will participate in the evaluation of the comprehensive examination. Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Criminology and Social Data Analytics. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/>

[graduate-education-policies/](#)), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

All students admitted to the program are supported with stipends and tuition waivers for either four years (students entering with a master's degree) or five years (students entering with a bachelor's degree). Support may be in the form of research assistantships or teaching assistantships, with most students receiving a combination of types of support across their graduate careers.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Criminology (CRIM) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/crim/>)

Learning Outcomes

1. **Know:** Graduates will demonstrate a deep conceptual understanding of criminological theory and the interrelated institutions and processes of the criminal justice system, as well as specialized knowledge in a sub-area of the discipline.
2. **Apply:** Graduates will be able to apply theory and current research to identify gaps in the literature and generate new knowledge in criminology.
3. **Communicate:** Graduates will be able to communicate with the discipline through clear, well-organized manuscripts, proposals, and formal presentations.
4. **Think:** Graduates will be able to critically analyze unpublished and published research by other scholars in criminology and in their specialty area.
5. **Professional Practice.** Graduates will demonstrate a commitment to active citizenship in the department and the discipline and engage

with research, as well as with colleagues and students, in an ethical manner.

Contact

Campus	University Park
Graduate Program Head	Michelle Lynn Frisco
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Pamela K Wilcox
Program Contact	Sierra Brooke Waite 213 Oswald Tower University Park PA 16802 sbw5348@psu.edu (814) 865-3455
Program Website	View (http://sociology.la.psu.edu/)

Curriculum and Instruction

Graduate Program Head	Scott McDonald
Program Code	CI
Campus(es)	University Park (Ph.D., M.S., M.Ed.) World Campus (M.Ed.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Master of Education (M.Ed.) Dual-Title Ph.D., M.S., or M.Ed. in Curriculum and Instruction and Comparative and International Education Dual-Title M.S. or Ph.D. in Curriculum and Instruction and Women's, Gender, and Sexuality Studies Integrated B.S. in Biology and M.Ed. in Curriculum and Instruction Integrated B.S. in Chemistry and M.Ed. in Curriculum and Instruction Integrated B.S. in Mathematics and M.Ed. in Curriculum and Instruction Integrated B.S. in Special Education and M.Ed. in Curriculum and Instruction
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=CI)

This program provides advanced professional preparation in the special areas of:

- Bilingual education
- Curriculum and supervision
- Early childhood education
- Elementary education
- Instructional leadership
- Language and literacy education
- Science education
- Social studies education
- Mathematics education

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

GRE scores will not be considered as part of admission decisions.

Students with appropriate course and professional backgrounds will be considered for admission. For admission to the professional degree programs leading to the M.Ed., teaching or equivalent experience and at least 18 credits in education are recommended.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students for more information.

Degree Requirements

Master of Education (M.Ed.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

M.Ed. students are expected to complete CI 590 as well as a core of one course in each of three areas:

Code	Title	Credits
Required Courses		
CI 590	Colloquium ¹	1
Select one course in each of the following three areas:		9
<i>Learning/Foundation</i>		
EDPSY 421	Learning Processes in Relation to Educational Practices	
EDPSY 526	The Psychology of Reading	
SCIED 552	Science Teaching and Learning	
CI 560	Theories of Childhood	
<i>Research</i>		
CI 400	Introduction to Research Literature	
CI 501	Teaching as Inquiry	
SCIED 558	Research Problems in Science Teaching	
STAT 500	Applied Statistics	
EDPSY 400	Introduction to Statistics in Educational Research	
<i>Curriculum</i>		
CI 550	Overview of Contemporary School Curriculum	
C-S 551	Curriculum Design: Theory and Practice	
SCIED 550	Science Education Curriculum	

¹ Through CI 590, students complete Scholarship and Academic Research Integrity (SARI) training.

M.Ed. candidates submit a professional master's culminating paper.

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

M.S. students are expected to complete CI 590 as well as a core of one course in each of three areas:

Code	Title	Credits
Required Courses		
CI 590	Colloquium ¹	1
Select one course in each of the following three areas:		9
<i>Learning/Foundation</i>		
EDPSY 421	Learning Processes in Relation to Educational Practices	
EDPSY 526	The Psychology of Reading	
SCIED 552	Science Teaching and Learning	
CI 560	Theories of Childhood	
<i>Research</i>		
CI 400	Introduction to Research Literature	
CI 501	Teaching as Inquiry	
SCIED 558	Research Problems in Science Teaching	
STAT 500	Applied Statistics	
EDPSY 400	Introduction to Statistics in Educational Research	
<i>Curriculum</i>		
CI 550	Overview of Contemporary School Curriculum	
C-S 551	Curriculum Design: Theory and Practice	
SCIED 550	Science Education Curriculum	

¹ Through CI 590, students complete Scholarship and Academic Research Integrity (SARI) training.

M.S. candidates are required to enroll in six credits of thesis research (CI 600 or CI 610) as they plan, conduct, and report a master's research thesis.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The completion of a core of competencies in curriculum, instruction, and supervision with at least one course in each area is expected of Ph.D. candidates. Additional course requirements include courses in an emphasis area, in quantitative or qualitative research methods, and in supporting courses that extend or complement the emphasis area. Emphasis areas include:

- Curriculum and Supervision
- Early Childhood Education
- Language, Culture, and Society
- English Language Arts Education
- Second Language Education
- Social Studies Education
- Mathematics Education
- Science Education

All students complete Scholarship and Academic Research Integrity (SARI) training through CI 590. In addition, each student completes all Degree Requirements of the Ph.D. and produces and defends a doctoral dissertation.

Dual-Titles

Dual-title Ph.D., M.S., or M.Ed. in Curriculum and Instruction and Comparative and International Education

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admissions Requirements

Students must apply and be admitted to the graduate program in Curriculum and Instruction and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Comparative and International Education dual-title program. Refer to the Admission Requirements section of the Comparative and International Education Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/comparative-international-education/>). Doctoral students must be admitted into the dual-title degree program in Comparative and International Education prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Curriculum and Instruction, listed in the Degree Requirements section. In addition, students must complete the degree requirements for the dual-title in Comparative and International Education, listed on the Comparative and International Education Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/comparative-international-education/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Curriculum and Instruction and must include at least one Graduate Faculty member from the Comparative and International Education program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Curriculum and Instruction and Comparative and International Education. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Curriculum and Instruction and Comparative and International Education dual-title Ph.D. student must include at least one member of the Comparative and International Education Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Comparative and International Education, the member of the committee representing Comparative and International Education must be appointed as co-chair. The Comparative and International Education representative on the

student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Curriculum and Instruction and Comparative and International Education. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-title M.S. or Ph.D. in Curriculum and Instruction and Women's, Gender, and Sexuality Studies

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admissions Requirements

Students must apply and be admitted to the graduate program in Curriculum and Instruction and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Women's, Gender, and Sexuality Studies dual-title program. Refer to the Admission Requirements section of the Women's, Gender, and Sexuality Studies Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/womens-gender-sexuality-studies/>). Doctoral students must be admitted into the dual-title degree program in Women's, Gender, and Sexuality Studies prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Curriculum and Instruction, listed in the Degree Requirements section. In addition, students must complete the degree requirements for the dual-title in Women's, Gender, and Sexuality Studies, listed on the Women's, Gender, and Sexuality Studies Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/womens-gender-sexuality-studies/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Curriculum and Instruction and must include at least one Graduate Faculty member from the Women's, Gender, and Sexuality Studies program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Curriculum and Instruction and Women's, Gender, and Sexuality Studies. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Curriculum and Instruction and Women's, Gender, and Sexuality Studies dual-title Ph.D. student must include at least two members of the Women's, Gender, and Sexuality Studies Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Women's, Gender, and Sexuality Studies, the member of the committee representing

Women's, Gender, and Sexuality Studies must be appointed as co-chair. The Women's, Gender, and Sexuality Studies representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Curriculum and Instruction and Women's, Gender, and Sexuality Studies. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Integrated Undergrad-Grad Programs

Integrated B.S. in Biology and M.Ed. in Curriculum and Instruction

This Integrated Undergraduate/Graduate (IUG) degree program combines the [Undergrad Degree in Major] with the [Grad Degree in Major] offered at the following campuses:

Undergraduate Degree

- Abington
- Altoona
- Beaver
- Berks
- Brandywine
- Harrisburg
- Schuylkill
- Scranton
- York

Graduate Degree

- University Park
- World Campus

The graduate portion of this IUG is currently offered as face-to-face residential instruction. While the undergraduate curriculum for this IUG may be completed at multiple campuses, the ease and feasibility of completing the integrated program may be heavily dependent upon the location of the graduate instruction. Please discuss the feasibility of completing the IUG with a representative for the graduate program before beginning the application process.

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

This Integrated Undergraduate/Graduate (IUG) degree program combines the Bachelor of Science in Biology with the Master of Education in

Curriculum and Instruction, Science Education emphasis. The program is designed to be completed in five years. The program enables highly qualified and motivated students to delve deeply into a scientific content area and to pursue graduate level preparation in the theory and practice of teaching. Most students in this option intend to seek Pennsylvania teacher certification, and a semester of student teaching comprises part of their final year of studies. The IUG may also be suitable for a student who does not need to become certified, because they intend to teach in a private secondary school or a non-formal educational setting; in such cases, the second graduate semester will be a program of studies determined through consultation with the graduate advisor and customized for the student's specific needs.

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students must apply to and meet admission requirements of the Graduate School (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>), as well as the graduate program in which they intend to receive their master's degree. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. Application materials to be submitted include:

- a current undergraduate transcript,
- statement of purpose,
- draft plan of study,
- two letters of recommendation,
- and concurrent submission of an application for master's study to the graduate program in Curriculum and Instruction, Science Education emphasis area.

In addition, a minimum GPA of 3.5 in Science and Education courses is required. Admission will be based on a recommendation by the Science Education Program Coordinator in consultation with the Associate Chair for Undergraduate Education in the Biology Department. Additional details about the graduate application procedure can be found in the Admission Requirements section. Applications must be submitted via the Graduate School.

IUG students fulfill all degree requirements for a B.S. in Biology in the Eberly College of Science, listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>). If a student chooses to leave the program without completing M.Ed. requirements, they may still receive the relevant B.S. degree, after all B.S. requirements are completed.

For the M.Ed. degree, students must earn at least 30 credits at the 400/500 level, at least 18 of them at the 500 level. Degree requirements for the M.Ed. degree are listed on the Degree Requirements tab. One graduate semester is usually devoted to full time student teaching. Additional graduate course work is completed in a second semester. Courses required for the M.Ed. degree include a course in learning theory (e.g., SCIED 552), a course in research methods (e.g., SCIED 558), a course in curriculum (e.g., SCIED 550), and a course in research ethics (CI 590).

Students pursuing teacher certification (the usual option) additionally complete a 500-level EDTHP course, CI 595, and CI 496. SCIED 558, CI 496, and CI 595 comprise the student-teaching semester course load. Students who are not pursuing teacher certification substitute 15 credits of other 400- or 500-level coursework for the student teaching semester; those courses are selected in consultation with their advisors, in order to address the students' specific career aspirations.

The following courses may be double-counted toward both the B.S. and the M.Ed. degrees, up to a limit of 12 credits: EDTHP 500-level courses, SCIED 411, SCIED 412, and SCIED 500-level courses. Note that at least 50% of credits proposed for double-counting must be at the 500 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted. In addition to the double-counted courses taken during the first four years, the timeline for the M.Ed. is one year that includes these specified courses. The program is designed to be finished in five years.

There are a number of other requirements for Pennsylvania teacher certification, including state-required tests and clearances, as well as course work that can be completed at either the undergraduate or graduate level. Some courses, not enumerated above, that are usually required to satisfy teacher certification requirements include CI 280, SPLED 400, and CI 495C. Please note that changes in Pennsylvania certification requirements are common; students should check the Certification FAQ page at the Penn State Science Education website (<https://ed.psu.edu/academics/departments/department-curriculum-and-instruction/program-areas/faq-science-education/>) for updates and clarification about the specific requirements that affect them, based on their admission date to the IUG program option. Note also that students in the IUG program option are not required to complete all Penn State teacher certification requirements in order to receive their B.S. and M.Ed. degrees, as long as they have completed the requirements for those degrees, as described in the Undergraduate and Graduate Bulletins. For example, a student who has completed all degree requirements but has not yet received a score for the Pennsylvania-required Biology content exam may be awarded both of the earned degrees.

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Integrated B.S. in Chemistry and M.Ed. in Curriculum and Instruction

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Chemistry with the M.ED. in Curriculum and Instruction offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- University Park

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

These Integrated Undergraduate/Graduate (IUG) degree programs combine the Bachelor of Science in Chemistry with the Master of Education in Curriculum and Instruction, Science Education emphasis. The programs are designed to be completed in five years. The programs enable highly qualified and motivated students to delve deeply into a scientific content area and to pursue graduate level preparation in the theory and practice of teaching.

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students must apply to and meet admission requirements of the Graduate School (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>), as well as the graduate program in which they intend to receive their master's degree. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. Application materials to be submitted include:

- an undergraduate transcript,
- statement of purpose,
- draft plan of study,
- two letters of recommendation,
- and concurrent submission of an application for master's study to the graduate program in Curriculum and Instruction, Science Education emphasis area.

In addition, a minimum GPA of 3.5 in Science and Education courses is required. Admission will be based on a recommendation by the Science Education Program Coordinator in consultation with the Associate Chair for Undergraduate Education in the Chemistry Department. Additional details about the graduate application procedure can be found in the Admissions Requirements section. Applications must be submitted via the Graduate School.

IUG students fulfill all degree requirements for a B.S. in Chemistry in the Eberly College of Science, listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>). If a student chooses to leave the program without completing M.Ed. requirements, they may still receive the relevant B.S. degree, after all B.S. requirements are completed.

For the M.Ed. degree, students must earn at least 30 credits at the 400/500 level, at least 18 of them at the 500 level. Degree requirements for the M.Ed. degree are listed on the Degree Requirements tab. One graduate semester is devoted to full time student teaching. Additional graduate course work is completed in a second graduate semester. Courses required for the M.Ed. degree include:

Code	Title	Credits
SCIED 552	Science Teaching and Learning	3
SCIED 558	Research Problems in Science Teaching ¹	3

500-level EDTHP course		3
CI 590	Colloquium	1
CI 595	Internship in Curriculum, Supervision, or Instruction ¹	12
500-level course in curriculum (e.g. SCIED 550)		3

¹ Of these, SCIED 558 and CI 595 comprise the student teaching semester course load.

The following courses may be double-counted toward both the B.S. and the M.Ed. degrees, up to a limit of 12 credits: EDTHP 500-level courses, SCIED 411 & SCIED 412, and SCIED 500-level courses. Note that at least 50% of credits proposed for double-counting must be at the 500 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted. In addition to the double-counted courses taken during the first four years, the timeline for the M.Ed. is one year that includes these specified courses. The program is designed to be finished in five years.

There are a number of other requirements for Pennsylvania teacher certification, including state-required tests and clearances, as well as course work that can be completed at either the undergraduate or graduate level. Some courses, not enumerated above, that are usually required to satisfy teacher certification requirements include CI 280, SPLED 400, and CI 495C. Please note that changes in Pennsylvania certification requirements are common; students should check the Certification FAQ page at the Penn State Science Education website (<https://ed.psu.edu/academics/departments/department-curriculum-and-instruction/program-areas/faq-science-education/>) for updates and clarification about the specific requirements that affect them, based on their admission date to the IUG program option. Note also that students in the IUG program option are not required to complete all Penn State teacher certification requirements in order to receive their B.S. and M.Ed. degrees, as long as they have completed the requirements for those degrees. For example, a student who has completed all degree requirements but has not yet received a score for the Pennsylvania-required Chemistry content exam may be awarded both of the earned degrees.

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Integrated B.S. in Mathematics and M.Ed. in Curriculum and Instruction

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Mathematics with the M.ED. in Curriculum and Instruction offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- University Park
- World Campus

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The Mathematics and Curriculum Instruction with Emphasis in Mathematics Education Integrated Undergraduate-Graduate (MATH/CI-MTHED IUG) Degree Program consists of the integration of required courses for a B.S. in Mathematics Systems Analysis Option, a M.Ed. in Curriculum and Instruction with emphasis in Mathematics Education (MTHED), and Pennsylvania certification for Mathematics Grades 7-12.

The MATH/CI-MTHED IUG is a five-year program for highly qualified students seeking to teach mathematics at the secondary level. A hallmark of the program is its strong statistics strand in combination with its mathematics core. In addition to developing advanced understanding of mathematics and statistics, students will learn how to develop and implement lessons and to incorporate technology and research in instruction designed to reach all students.

Students are expected to complete courses required for the certification program integrated with their undergraduate and graduate experiences and will likely complete one summer in residence. Completion of the IUG (along with earning a passing score on Pennsylvania Department of Education required test[s]) leads to a B.S. in Mathematics, certification in Mathematics Grades 7-12, and a M.Ed. in Curriculum and Instruction.

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students must apply to and meet admission requirements of the Graduate School (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>), as well as the graduate program in which they intend to receive their master's degree. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. Admission to the MATH/CI-MTHED IUG Mathematics Grades 7-12 program will be based upon having attained a minimum GPA of 3.5 after completing at least 60 credits of the program, with a grade of C or better in all courses. Application materials to be submitted include:

- a current undergraduate transcript,
- statement of purpose,
- draft plan of study,
- two letters of recommendation,
- and concurrent submission of an application for master's study to the graduate program in Curriculum and Instruction, Mathematics Education emphasis area.

Admission will be based on a recommendation by the Mathematics Department in consultation with the Mathematics Education faculty in the Department of Curriculum and Instruction.

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.S. in Mathematics are listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/bulletins/bluebook/>). Degree requirements for the M.Ed. degree are listed on the Degree Requirements tab. For the B.S./M.Ed. Degree in integrated Mathematics B.S. and Curriculum and Instruction M.Ed., 129 credits are required for the B.S. degree, 30 credits are required for the M.Ed., and 41 credits are required for field experiences and additional courses required for secondary mathematics certification in Pennsylvania. A maximum of 12 credits, at least half of which are at the 500-level, may be dual-counted toward the B.S. and M.Ed. The following courses can be used in both the B.S. and the M.Ed. degrees: two MATH 400-level electives, STAT 501, STAT 502. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted. Students can complete the B.S. in Mathematics and not advance to the M.Ed. Curriculum and Instruction degree if they desire. Students who have been accepted into the IUG program but are unable to complete the M.Ed. in Curriculum and Instruction may be awarded the B.S. in Mathematics after having completed all degree requirements for the B.S. The M.Ed. requires one full year beyond the B.S., including student teaching in the graduate year.

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Code	Title	Credits
Required Courses		
9 credits - choose one course from each area		9
<i>Curriculum</i>		
CI 550	Overview of Contemporary School Curriculum (or equivalent)	
<i>Research</i>		
STAT 500	Applied Statistics (or equivalent)	
<i>Learning</i>		
EDPSY 421	Learning Processes in Relation to Educational Practices (or equivalent)	
Emphasis in Mathematics Education		
CI 590	Colloquium ¹	1-3
STAT 501	Regression Methods ¹	3
Select one of the following:		3
MATH 485	Graph Theory	
MATH 486	Mathematical Theory of Games	
MATH/CMPSC 451	Numerical Computations	
MTHED 511	Connections Between Mathematics and Mathematics Education (or equivalent) ¹	3
MTHED 524	¹	

Select at least one additional 400-level MATH course²
 Select at least one additional 400- or 500-level MTHED course

- 1 Required courses.
- 2 Other than:
 - MATH 401
 - MATH 405
 - MATH 406
 - MATH 441
 - MATH 470
 - MATH 471

A Master's paper is required for completion of the M.Ed.

A passing score on the state-required Mathematics Content Exam is required for Mathematics Grades 7-12 certification.

Integrated B.S. in Special Education and M.Ed. in Curriculum and Instruction

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Special Education with the M.Ed. in Curriculum and Instruction offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- University Park
- World Campus

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The Special Education and Curriculum and Instruction with emphasis in Language and Literacy Education Integrated Undergraduate-Graduate (SE/CI-LLED IUG) leading to certification as a Reading Specialist.

The Special Education and Curriculum Instruction with Emphasis in Language and Literacy Education Integrated Undergraduate-Graduate (SE/CI-LLED IUG) Degree Program consists of integration of required courses for a B.S. in Special Education with courses required for certification as a Reading Specialist and a M.Ed. in Curriculum and Instruction with emphasis in Language and Literacy Education (LLED). The five-year, SE/CI-LLED IUG is an option for highly qualified students seeking certification to teach Special Education in Pennsylvania in grades K-12. Students in this IUG will be taught how to design and deliver appropriate instruction based on individual needs and incorporate a variety of materials and strategies. Students are expected to complete courses required for the graduate level K-12 reading specialist integrated with their undergraduate experiences and coursework in Special Education and will complete a summer practicum in an on-campus reading clinic as well as a capstone Special Education teaching experience in their final semester. Completion of the IUG (along with earning a passing score on PDE required content tests) leads to a B.S.

in Special Education, certification in special education and as a reading specialist in the state of Pennsylvania, and a M.Ed. in Curriculum and Instruction.

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students must apply to and meet admission requirements of the Graduate School (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>), as well as the graduate program in which they intend to receive their master's degree. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. In consultation with an adviser, students must prepare a plan of study appropriate to this integrated program, and must present their plan of study to the head of the graduate program or the appropriate committee overseeing the integrated program prior to being admitted to the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.

In addition to the admission requirements for the Curriculum and Instruction M.Ed., admission to the SE/CI-LLED IUG Reading Specialist program will be based upon having attained a minimum GPA of 3.5 in Special Education courses, with a grade of B or better in SPLED 412. Admission will be based on a recommendation by the Reading Specialist Program Coordinator in consultation with the Coordinator of Teacher Education in Special Education.

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.S. in Special Education are listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/bulletins/bluebook/>). Degree requirements for the M.Ed. degree are listed on the Degree Requirements tab. For the B.S./M.Ed. Degree in integrated Special Education B.S. and Curriculum and Instruction M.Ed., a minimum of 150 credits is required. Up to 12 credits can apply to both undergraduate and graduate degrees; half of these must be at the 500-level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted. Students who have been accepted into the IUG program but are unable to complete the M.Ed. in Curriculum and Instruction may be awarded the B.S. in Special Education after having completed all degree requirements for the B.S.

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Code	Title	Credits
Required Courses		
9 credits - choose one course from each area:		9
	<i>Curriculum</i>	

CI 550	Overview of Contemporary School Curriculum	
<i>Research</i>		
CI 501	Teaching as Inquiry	
EDPSY 400	Introduction to Statistics in Educational Research	
<i>Learning</i>		
EDPSY 421	Learning Processes in Relation to Educational Practices	
HDFS 429	Advanced Child Development	
Emphasis in Language and Literacy Education with Reading Specialist		
EDLDR 563	Designing Staff Development Programs	3
EDPSY 526	The Psychology of Reading	3
LLED 500	The Reading and Writing Classroom ¹	3
LLED 501	Teaching Writing in Elementary and Secondary Schools ¹	3
LLED 550	Theory and Practicum in Assessment and Remediation of Reading Difficulties ¹	3
LLED 595A	¹	3-6
Total Credits		30

1 Required courses.

A Master's paper is required for completion of the M.Ed.

A passing score on the state-required Reading Specialist Exam (qualifying score of 570) is required for Reading Specialist certification.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Curriculum and Instruction (CI) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/ci/>)

Curriculum and Supervision (C-S) course list (https://bulletins.psu.edu/university-course-descriptions/graduate/c_s/)

Early Childhood Education (ECE) course list (<https://bulletins.psu.edu/university-course-descriptions/graduate/ece/>)

Language and Literacy Education (LLED) course list (<https://bulletins.psu.edu/university-course-descriptions/graduate/lled/>)

Mathematics Education (MTHED) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/mthed/>)

Science Education (SCIED) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/scied/>)

Social Studies Education (SSED) course list (<https://bulletins.psu.edu/university-course-descriptions/graduate/ssed/>)

Learning Outcomes

- Demonstrate mastery of the student's specific program emphasis area, which includes knowledge of primary and secondary literature related to research methodologies, programmatic research priorities, and implications of that research for professional practice. Assessed through candidacy and comprehensive exams (rubric).
- Students will design and carry out a research project that includes articulating an important and original question, analyzing appropriate literature, demonstrating conceptual and methodological creativity, and carrying out an original inquiry. Assessed through dissertation proposal and defense (rubric).
- Demonstrate standards of field in written and oral communication by presenting the results of dissertation research in clear, concise oral presentations to an audience of peers. Assessed through dissertation defense.
- Demonstrate critical thinking about selected recent research in the program emphasis area through the description of an emerging scholarly theme/area, identification of specific publications that reflect it, and assessment of its strengths and weaknesses. Assessed through written and oral candidacy assessment (rubric).
- Demonstrate knowledge and comprehension of research ethics issues including knowledge of ethical principles related to authorship, research reporting, data fabrication, plagiarism, conflicts of interest, peer review, data sharing and other areas of misconduct. Assessed through SARI examinations and participation in CI 590.

Professional Licensure/Certification

Many U.S. states and territories require professional licensure/certification to be employed. If you plan to pursue employment in a licensed profession after completing this program, please visit the

Professional Licensure/Certification Disclosures by State (<https://www.psu.edu/state-licensure-disclosures/>) interactive map.

Contact

Campus	University Park
Graduate Program Head	Scott P Mcdonald
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Kimberly Anne Powell
Program Contact	Kimberly Erin Waite Curriculum Instruction 270A Chambers Building University Park PA 16802 ked130@psu.edu (814) 865-2168
Program Website	View (https://ed.psu.edu/academics/departments/department-curriculum-and-instruction/)
Campus	World Campus
Graduate Program Head	Scott P Mcdonald
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Kimberly Anne Powell
Program Contact	Kayla McCloskey 170 Chambers Building Penn State University University Park PA 16802 kkm5615@psu.edu (814) 865-2430
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/curriculum-and-instruction-masters/overview/)

Cybersecurity Analytics and Operations

Graduate Program Head	Carleen Maitland
Program Code	CYMPS
Campus(es)	University Park (M.S.) World Campus (M.P.S.)
Degrees Conferred	Master of Science (M.S.) Master of Professional Studies (M.P.S.) Integrated B.S. in Cybersecurity and Analytics and M.S. in Cybersecurity and Analytics Integrated B.S. in Cybersecurity and Analytics and M.P.S. in Cybersecurity and Analytics Integrated B.S. in Enterprise Technology Integration and M.S. in Cybersecurity and Analytics Integrated B.S. in Human-Centered Design and Development and M.S. in Cybersecurity and Analytics
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=CYMPS)

The Master of Science in Cybersecurity Analytics and Operations program is designed to create a deep understanding of cybersecurity analytics and operations, by blending education relating to technology, incident response, strategic planning, and crisis management. The program also aims to prepare the next generation of cybersecurity analysts to better protect digital information from attack through cyberdefense strategies, including incident response, strategic planning, and crisis management. With a foundation in mathematics and computer programming, students will be prepared to recognize, analyze, defend against, and manage risks related to a wide range of threats to online information, data stores, and networks. The program will be delivered in a resident format that takes one to two years. The total credits of the program is 30. A one-year program starts in a Fall semester, and concludes at the end of the following Summer.

The Master of Professional Studies in Cybersecurity Analytics and Operations (MPSCY) is an innovative program that targets professionals and organizational leaders who seek a professional education and training program. The purpose of the professional master's program is to produce professionals and organizational leaders who not only can select and draw upon the necessary foundations within the cybersecurity analytics and operations technology areas, test the applicability of these foundations for addressing a given issue, and apply the resulting solutions, but also can be aware of the multitude of technological trends and environmental factors that organizations must address in the changing global economy. The M.P.S. equips students to: understand and analyze the profound information and technological changes sweeping the world; meet challenges by developing innovative solutions using the foundations of cybersecurity analytics and operations; and have a clear advantage in today's highly competitive and dynamic environment by continuously learning new trends, issues, and innovations.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Master of Professional Studies (M.P.S.)

Applicants to the M.P.S. program are required to submit three letters of reference, and a one-three page personal statement of relevant experience and goals.

Because the M.P.S. program is multidisciplinary in nature, students from many different disciplines may be accepted for entry into the program. A bachelor's degree in a related area (e.g., engineering and science), while not necessary for admission, is helpful in the successful completion of the degree. It is expected that students will have a basic level of competency in statistics, as well as computer and information technology. Related work experience can be used to demonstrate such competency. A student may be accepted into the program with provisional status (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/provisional-admission/>) for no more than one year while work is completed to meet these expectations.

It is expected that the successful applicant will have an overall grade point average of 3.00 (on a 4.00 scale) or higher for his or her undergraduate study and/or graduate-level study. However, accomplishments demonstrated through work experience and recommendation letters from the applicant's academic adviser or employer will also play an important role in making the admission decision. The most qualified applicants will be accepted into the program until all spaces for new students are filled.

Master of Science (M.S.)

Applicants to the M.S. program are required to submit three letters of reference, a current resume (including present position and any publications), 1 to 3 page statement of goals related to pursuing an advanced degree and career in IST and provide a sample of the applicant's writing (e.g. technical paper, etc.).

Because cybersecurity analytics and operations career opportunities exist in many disciplines, students with a wide range of disciplinary backgrounds may be accepted into the program. A bachelor's degree in a related area (e.g., engineering and science), while not necessary for admission, is helpful in the successful completion of the degree. However, it is expected that students will have a basic level of competency in mathematics and programming.

Entrance Requirement regarding Programming: Applicants must complete two introductory-level programming courses where both courses used the same language. If an applicant believes his/her work experience satisfies the background, he/she should include a recommendation letter from a technical colleague describing the applicant's coding contributions at work. In addition, students who meet all other academic requirements, but need to improve identified gaps in specific programming skills areas, will have access to educational bridge materials to help improve certain knowledge domains

It is expected that the successful applicant will have an overall grade point average of 3.50 (on a 4.00 scale) or higher for his or her undergraduate study and/or graduate-level study. However, accomplishments demonstrated through work experience and

recommendation letters from the applicant's academic adviser or employer will also play an important role in the admission decision as well. The most qualified applicants will be accepted into the program until all spaces for new students are filled.

Degree Requirements

Master of Professional Studies (M.P.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The M.P.S. program requires a minimum of 33 credits at the 400, 500, or 800 level, 24 of which must be earned at Penn State. A maximum of 9 transfer credits of high-quality graduate work may be applied toward the requirements for the degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). At least 18 credits must be courses at the 500 or 800 level, with at least 6 credits at the 500 level.

The 33 credits are distributed among the following requirements. A student first takes 18 credits of core courses. The student then takes 12 credits of electives. Lastly, the student must complete a culminating experience.

Elective Courses

The elective courses for the M.P.S. will be selected from a list maintained by the program office.

Culminating Experience

The student may choose one of two culminating experiences for the degree: either the capstone project guided by the student's adviser and completed while enrolled in IST 594, or the capstone course IST 894.

Code	Title	Credits
Required Courses		
IST 543	Foundations of Software Security	3
IST 554	Network Management and Security	3
IST 815	Foundations of Information Security and Assurance	3
IST 820	Cybersecurity Analytics	3
IST 825	Technologies for Web and E-Commerce Application Security	3
IST 830	Cybersecurity Project Management	3
Electives		
Select 12 credits of electives from a list of approved electives available from the program office.		12
Culminating Experience		
Choose one of the following:		3
IST 594	Research Topics (Capstone Project)	
IST 894	Capstone Experience (Capstone Course)	
Total Credits		33

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The M.S. in Cybersecurity Analytics and Operations requires a minimum of 30 credits at the 400, 500, 600, or 800 level, with at least 18 credits in the 500 or 600 series combined; 27 of the 30 credits must be

earned at Penn State (refer to GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>)). Students will be able to complete the proposed Master's program in one calendar year (including summer) or two academic years. All of the courses listed below are three credit hour courses, unless otherwise noted. Students pursuing the one-year format must adhere to the following conditions:

- A research adviser must be assigned to students in their first semester, as selection and discussion of the student's research topic must begin as soon as possible.
- Students who need more time to complete the final paper must be allowed to complete the paper, and have it reviewed and approved after the third semester (Summer) has ended. Students are not required to remain in residence while they complete the final paper. However, extensions granted to students in this program must comply with the Graduate Council policy on deferred grades (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-400/gcac-401-grading-system/>).

These 30 credits are distributed among the following requirements:

Code	Title	Credits
Required Courses		
IST 543	Foundations of Software Security	3
IST 554	Network Management and Security	3
IST 815	Foundations of Information Security and Assurance	3
IST 820	Cybersecurity Analytics	3
IST 825	Technologies for Web and E-Commerce Application Security	3
Electives		
Select 9-12 elective credits from a list available from the program office.		9-12
Culminating Experience		
Choose one of the following:		
IST 584	Cyber Simulation Event and Analysis	3
IST 594	Research Topics (Scholarly Paper)	3-6
IST 600	Thesis Research	6
Total Credits		30

Thesis, Scholarly paper, or Capstone course (3-6 credits)

Students may choose a thesis, scholarly paper or capstone course option. Students who choose the thesis option must register for 6 credits of IST 600 or IST 610, write a satisfactory thesis accepted by the master's committee, the head of the graduate program, and the Graduate School, and pass a thesis defense. The thesis should focus on a well-defined problem relevant to the information sciences. Students who choose the thesis option must also complete IST 505. Student who choose the scholarly paper option must register for 3 credits of IST 594 and complete the scholarly paper. The scholarly paper will be a focused piece of technical work that applies the student's expertise and knowledge base, and that is documented and presented as a scholarly paper report. Students who choose the capstone course option must register for IST 584 to complete the capstone course requirement. Students who choose the scholarly paper option or capstone course option must complete at least 18 credits at the 500 level.

Integrated Undergrad-Grad Programs

Integrated B.S. in Cybersecurity Analytics and operations and M.S. in Cybersecurity Analytics and Operations

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Cybersecurity Analytics and Operations with the M.S. in Cybersecurity Analytics and Operations offered at the following campuses:

Undergraduate Degree

- Abington
- Altoona
- Beaver
- Berks
- Brandywine
- Greater Allegheny
- Harrisburg
- Lehigh Valley
- Schuylkill
- Shenango
- University Park
- World Campus
- York

Graduate Degree

- University Park

The graduate portion of this IUG is currently offered as face-to-face residential instruction. While the undergraduate curriculum for this IUG may be completed at multiple campuses, the ease and feasibility of completing the integrated program may be heavily dependent upon the location of the graduate instruction. Please discuss the feasibility of completing the IUG with a representative for the graduate program before beginning the application process.

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The first two to three years of undergraduate course work follow the same undergraduate curriculum that other students follow in the Cybersecurity Analytics and Operations major. Cybersecurity Analytics and Operations undergraduates may apply for admission to the IUG program no earlier than February 15th of their second undergraduate year and no later than February 15 of their third undergraduate year after completing a minimum of 60 credits, if they meet the following admission requirements:

1. Must be enrolled in a College of IST undergraduate degree program.
2. Must have completed entrance to their undergraduate major and must have completed 60 credits of an IST undergraduate degree program. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.
3. Must apply to the IUG program by February 15 of their third undergraduate year.
4. Must apply to and be accepted without reservation into the Graduate School and M.S. program in Cybersecurity Analytics and Operations. Students must complete the Graduate School application (<http://www.gradschool.psu.edu/apply/>). Admission requirements for the M.S. in Cybersecurity Analytics and Operations are listed on the Admissions Requirements tab.
5. Must have an overall GPA of 3.5 (on a 4.0 scale) in undergraduate course work and a minimum GPA of 3.5 in all course work completed for the major.
6. Must present an approved plan of study. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser.
7. Must present two letters of recommendation from faculty members.
8. Must meet with both the Director of Undergraduate Academic Affairs and the Graduate Program Coordinator to declare interest and receive information about the IUG program.

Degree Requirements

Students must fulfill all degree requirements for each degree to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Science in Cybersecurity Analytics and Operations are listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>). Students must sequence their courses, so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.S. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted credits must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted. Students may choose 12 credits to double-count for both the undergraduate and graduate degrees from the following:

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
IST 432	Legal and Regulatory Environment of Information Science and Technology	3
IST 451	Network Security	3
IST 454	Computer and Cyber Forensics	3
IST 456	Information Security Management	3
IST 504	Foundations of Theories and Methods of Information Sciences and Technology Research	3
IST 554	Network Management and Security	3

IST 815	Foundations of Information Security and Assurance	3
IST 820	Cybersecurity Analytics	3

Integrated B.S. in Cybersecurity Analytics and operations and M.P.S. in Cybersecurity Analytics and Operations

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Cybersecurity Analytics and Operations with the M.S. in Cybersecurity Analytics and Operations offered at the following campuses:

Undergraduate Degree

- Abington
- Altoona
- Beaver
- Berks
- Brandywine
- Greater Allegheny
- Harrisburg
- Lehigh Valley
- Schuylkill
- Shenango
- University Park
- World Campus
- York

Graduate Degree

- World Campus

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The first two to three years of undergraduate course work follow the same undergraduate curriculum that other students follow in the Cybersecurity Analytics and Operations major. Cybersecurity Analytics and Operations undergraduates may apply for admission to the IUG program as early as the end of their second undergraduate year after completing a minimum of 60 credits, if they meet the following admission requirements:

1. Must be enrolled in a College of IST undergraduate degree program.
2. Must have completed entrance to their undergraduate major and must have completed 60 credits of an IST undergraduate degree program. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.
3. Must apply to and be accepted without reservation into the Graduate School and M.P.S. program in Cybersecurity Analytics and Operations. Students must complete the Graduate School application

(<http://www.gradschool.psu.edu/apply/>). Admission requirements for the M.P.S. in Cybersecurity Analytics and Operations are listed on the Admissions Requirements tab.

4. Must have an overall GPA of 3.5 (on a 4.0 scale) in undergraduate course work and a minimum GPA of 3.5 in all course work completed for the major.
5. Must present an approved plan of study. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser.
6. Must present two letters of recommendation from faculty members.
7. Must meet with both the Director of Undergraduate Academic Affairs and the Graduate Program Coordinator to declare interest and receive information about the IUG program.

Degree Requirements

Students must fulfill all degree requirements for each degree to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Science in Cybersecurity Analytics and Operations are listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>). Students must sequence their courses, so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.S. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted credits must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted. Students may choose 12 credits to double-count for both the undergraduate and graduate degrees from the following:

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
IST 432	Legal and Regulatory Environment of Information Science and Technology	3
IST 451	Network Security	3
IST 454	Computer and Cyber Forensics	3
IST 456	Information Security Management	3
IST 554	Network Management and Security	3
IST 815	Foundations of Information Security and Assurance	3
IST 820	Cybersecurity Analytics	3

Integrated B.S. in Enterprise Technology Integration and M.S. in Cybersecurity Analytics and Operations

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Enterprise Technology Integration with the M.S. in Cybersecurity Analytics and Operations offered at the following campuses:

Undergraduate Degree

- Harrisburg
- University Park
- World Campus

Graduate Degree

- University Park

The graduate portion of this IUG is currently offered as face-to-face residential instruction. While the undergraduate curriculum for this IUG may be completed at multiple campuses, the ease and feasibility of completing the integrated program may be heavily dependent upon the location of the graduate instruction. Please discuss the feasibility of completing the IUG with a representative for the graduate program before beginning the application process.

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The first two to three years of undergraduate course work follow the same undergraduate curriculum that other students follow in the Enterprise Technology Integration major. Enterprise Technology Integration undergraduates may apply for admission to the IUG program no earlier than February 15th of their second undergraduate year and no later than February 15 of their third undergraduate year after completing a minimum of 60 credits, if they meet the following admission requirements:

1. Must be enrolled in a College of IST undergraduate degree program.
2. Must have completed entrance to their undergraduate major and must have completed 60 credits of an IST undergraduate degree program. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.
3. Must apply to the IUG program by February 15 of their third undergraduate year.
4. Must apply to and be accepted without reservation into the Graduate School and M.S. program in Cybersecurity Analytics and Operations. Students must complete the Graduate School application (<http://www.gradschool.psu.edu/apply/>). Admission requirements for the M.S. in Cybersecurity Analytics and Operations are listed on the Admissions Requirements tab.
5. Must have an overall GPA of 3.5 (on a 4.0 scale) in undergraduate course work and a minimum GPA of 3.5 in all course work completed for the major.
6. Must present an approved plan of study. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser.
7. Must present two letters of recommendation from faculty members.
8. Must meet with both the Director of Undergraduate Academic Affairs and the Graduate Program Coordinator to declare interest and receive information about the IUG program.

Students must fulfill all degree requirements for each degree to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Science in Enterprise Technology Integration are listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>). Students must sequence their courses, so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.S. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted credits must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted. Students may choose 12 credits to double-count for both the undergraduate and graduate degrees from the following:

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
ETI 435	Enterprise Analytics	3
ETI 461	Database Management and Administration	3
ETI 463	Distributed Database Management Systems	3
IST 402	Emerging Issues and Technologies	3
IST 423	Enterprise Information Management and Storage Architecture	3
IST 440W	Information Sciences and Technology Integration and Problem Solving	3
IST 504	Foundations of Theories and Methods of Information Sciences and Technology Research	3
IST 505	Foundations of Research Design in Information Sciences and Technology	3
IST 543	Foundations of Software Security	3
IST 815	Foundations of Information Security and Assurance	3

Integrated B.S. in Human-Centered Design and Development and M.S. in Cybersecurity Analytics and Operations

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Human-Centered Design and Development with the M.S. in Cybersecurity Analytics and Operations offered at the following campuses:

Undergraduate Degree

- Harrisburg
- University Park

Graduate Degree

- University Park

The graduate portion of this IUG is currently offered as face-to-face residential instruction. While the undergraduate curriculum for this IUG

may be completed at multiple campuses, the ease and feasibility of completing the integrated program may be heavily dependent upon the location of the graduate instruction. Please discuss the feasibility of completing the IUG with a representative for the graduate program before beginning the application process.

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The first two to three years of undergraduate course work follow the same undergraduate curriculum that other students follow in the Enterprise Technology Integration major. Enterprise Technology Integration undergraduates may apply for admission to the IUG program no earlier than February 15th of their second undergraduate year and no later than February 15 of their third undergraduate year after completing a minimum of 60 credits, if they meet the following admission requirements:

1. Must be enrolled in a College of IST undergraduate degree program.
2. Must have completed entrance to their undergraduate major and must have completed 60 credits of an IST undergraduate degree program. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.
3. Must apply to the IUG program by February 15 of their third undergraduate year.
4. Must apply to and be accepted without reservation into the Graduate School and M.S. program in Cybersecurity Analytics and Operations. Students must complete the Graduate School application (<http://www.gradschool.psu.edu/apply/>). Admission requirements for the M.S. in Cybersecurity Analytics and Operations are listed on the Admissions Requirements tab.
5. Must have an overall GPA of 3.5 (on a 4.0 scale) in undergraduate course work and a minimum GPA of 3.5 in all course work completed for the major.
6. Must present an approved plan of study. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser.
7. Must present two letters of recommendation from faculty members.
8. Must meet with both the Director of Undergraduate Academic Affairs and the Graduate Program Coordinator to declare interest and receive information about the IUG program.

Students must fulfill all degree requirements for each degree to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Science in Human-Centered Design and Development are listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>). Students must sequence their courses, so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements

will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.S. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted credits must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted. Students may choose 12 credits to double-count for both the undergraduate and graduate degrees from the following:

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
IST 402	Emerging Issues and Technologies	3
IST 411	Distributed-Object Computing	3
IST 412	The Engineering of Complex Software Systems	3
IST 504	Foundations of Theories and Methods of Information Sciences and Technology Research	3
IST 543	Foundations of Software Security	3
IST 815	Foundations of Information Security and Assurance	3
IST 820	Cybersecurity Analytics	3

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Refer to the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students in this program are not eligible for graduate assistantships.

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Information Sciences and Technology (IST) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/ist/>)

Learning Outcomes

Master of Professional Studies (M.P.S.)

1. **KNOW:** Recognize, understand, identify and assess potential threats, vulnerabilities, and consequences in a context from local to global environments.
2. **APPLY/CREATE:** Integrate the use of disciplinary methods, techniques, and knowledge to solve practical, real-world problems.
3. **COMMUNICATE:** Present scientific evidence and best practice to inform and improve practical, real-world decisions.
4. **THINK:** Search, evaluate, and synthesize literature to integrate cyber security principles into disciplines and professional fields.
5. **PROFESSIONAL PRACTICE:** Make use of ethical standards and principles of integrity as a foundation in decision-making.

Master of Science (M.S.)

1. **KNOW:** Demonstrate appropriate breadth and depth of interdisciplinary knowledge and comprehension of the major issues in cybersecurity analytics and operations.
2. **APPLY/CREATE:** Use interdisciplinary knowledge and methods of cybersecurity analytics and operations to plan and conduct a research thesis or scholarly paper.
3. **COMMUNICATE:** Communicate the major issues of cybersecurity analytics and operations effectively.
4. **THINK:** Demonstrate analytical and critical thinking within cybersecurity analytics and operations, including across discipline.
5. **PROFESSIONAL PRACTICE:** Know and conduct themselves in accordance with the highest ethical standards, values, and, where these are defined, the best practices of cybersecurity analytics and operations (as expressed in SARI training modules).

Contact

Campus	University Park
Graduate Program Head	Carleen Maitland
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	David Joseph Fusco
Program Contact	Chrissie Fitzgerald cml195@psu.edu (814) 863-9461
Program Website	View (https://ist.psu.edu/prospective/graduate/)

Campus	World Campus
Graduate Program Head	Carleen Maitland
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	David Joseph Fusco
Program Contact	Chrissie Fitzgerald College of Information Sciences and Technology E397 Westgate Building University Park PA 16802 cml195@psu.edu (814) 863-9461
Program Website	View (https://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-cybersecurity-analytics-and-operations-masters-degree/overview/)

Data Analytics

Graduate Program Head	Raghu Sangwan
Program Code	DAAN
Campus(es)	Great Valley (M.D.A., M.S.) World Campus (M.D.A.)
Degrees Conferred	Master of Science (M.S.) Master of Data Analytics (M.D.A.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=DAAN)

Penn State Great Valley offers two graduate programs that cultivate the skills to collect, classify, analyze, and model data: the Master of Data Analytics (MDAAN) and the Master of Science in Data Analytics (MSDAAN). Both programs are STEM designated.

The Master of Science in Data Analytics (MSDAAN) degree is a research-oriented graduate degree program focused on applying predictive and prescriptive analytics to problems across domains. The program will provide students the skills necessary to frame problems in analytical terms amenable to data analysis; identify the datasets necessary to address the problem; the techniques appropriate to reveal the insight sought, and present that insight to stakeholders.

The MSDAAN curriculum is delivered in residence at the School of Graduate Professional Studies (Great Valley).

The Master of Data Analytics (MDAAN) degree is an interdisciplinary master's program that provides students the skills required to collect, classify, analyze, and model data at large and ultra-large scales and across domains using statistics, computer science, machine learning, and software engineering.

The MDAAN curriculum is delivered both in residence at the School of Graduate Professional Studies (Great Valley) and online through the Penn State World Campus.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to

Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Master of DATA ANALYTICS (M.D.A.)

Admission to the Master of Data Analytics (MDAAN) program will be based on baccalaureate academic records, applicable work experience, and two letters of recommendation from previous professors or supervisors who can attest to the applicant's academic potential. Applicants with an undergraduate degree in a quantitative discipline such as science, engineering, or business may apply. Students from other disciplines will be considered based on prior course work and/or standardized test scores. Applications must include a statement of professional goals, a curriculum vitae or resume, and two letters of recommendation. GRE scores are not required for admission. An undergraduate cumulative grade-point average of 3.0 or better on a 4.0 scale in the final two years of undergraduate studies is required.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Master of Science (M.S.)

Admission to the Master of Science in Data Analytics program will be based on baccalaureate academic records, applicable work experience, and two letters of recommendation from a previous professor or supervisor who can attest to the applicant's academic potential. Applicants with an undergraduate degree in a quantitative discipline such as science, engineering, or business may apply. Students from other disciplines will be considered based on prior course work and/or standardized test scores. Applications must include a statement of professional goals, a curriculum vitae or resume, and two letters of recommendation. Test scores from the GMAT or GRE exams are required. An undergraduate cumulative grade-point average of 3.0 or better on a 4.0 scale in the final two years of undergraduate studies is required.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of DATA ANALYTICS (M.D.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The MDAAN degree is conferred upon students who earn a minimum of 30 credits of coursework while maintaining an average grade-point average of 3.0 or better in all course work, including at least 18 credits at the 500 or 800 level (with at least 6 credits at the 500 level). The program curriculum includes 9 credits of core courses, 9 credits of either a selected option or the base program, 9 credits of electives, and a 3-credit capstone course.

Students select to follow either the base program, which prepares them to design and deploy predictive analytics systems, or specialized options in Business Analytics, Marketing Analytics, or Big Data Systems. The

base program is available both in residence and online; the options are only available online.

Code	Title	Credits
Required Courses		
STAT 500	Applied Statistics	3
IE 575	Foundations of Predictive Analytics	3
SWENG 545	Data Mining	3
or STAT 557	Data Mining I	
<i>Base Program or Option</i>		9
Electives ¹		9
Culminating Experience ²		3
Total Credits		30

¹ An additional 9 credits of elective courses must be selected from the approved list. The list of approved elective courses is maintained by the graduate program office.

² All students will complete their program of study with the capstone course corresponding to their chosen option.

All students will complete their program of study with the capstone course corresponding to their chosen option. While each capstone course focuses on problems relevant to their specific domains, they all provide students with an opportunity to apply their knowledge of the theories, methods, processes, and tools of data analytics, learned throughout their program, in a culminating and summative experience. The choice of project topic and exact form will be mutually determined by the instructor and each student. A written paper based on the applied project is required and must contain project description, analysis, and interpretation of its findings. Students are encouraged to upload their capstone projects to be available publicly via ScholarSphere and to participate in the Graduate Exhibition.

Base Program

(Offered at Penn State Great Valley and through World Campus)

The base program will create graduates who can design, deploy, and manage the technology infrastructure and data analytical processes of predictive analytics including data aggregation, cleaning, storage, and retrieval. These graduates will work in positions that require them to design and maintain data analytics systems and tools such as Data Analyst, Data Scientist, Business Analyst, Quantitative Analyst, or Information Officer.

Code	Title	Credits
Required Courses		
DAAN 881	Data-Driven Decision Making	3
DAAN 871	Data Visualization	3
DAAN 846	Network and Predictive Analytics for Socio-Technical Systems	3
Culminating Experience		
DAAN 888	Design and Implementation of Analytics Systems	3

Big Data Systems Option

(Offered at Penn State Great Valley and through World Campus)

The Big Data System option will create graduates who can select, apply, and interpret a variety of data analytic methods and data visualization techniques to business related problems. These graduates will work in positions that require them to design and maintain data analytics

systems and tools such as Data Modeler, Data Architect, Extraction, Transformation, Loading (ETL) Developer, Business Intelligence (BI) Developer, Data Warehouse Developer and Data Analyst.

Code	Title	Credits
Required Courses		
DAAN 825	Large-Scale Database and Warehouse	3
DAAN 826	LARGE SCALE DATABASES FOR REAL-TIME ANALYTICS	3
DAAN 822	Data Collection and Cleaning	3
Culminating Experience		
DAAN 888	Design and Implementation of Analytics Systems	3

Business Analytics option

(Offered through World Campus)

This option prepares graduates to explore and analyze large data sets to support data-driven business decisions. Target audiences include business analysts, analytic system designers and the data scientists who have a focus on problems arising in the context of business decision-making. The BAN option is organized around the industry-standard rubric of the spectrum of analytics activities: descriptive (what happened), diagnostic (why did it happen), predictive (what will happen) and prescriptive (what should happen).

Code	Title	Credits
Required Courses		
BAN 830	Descriptive Analytics for Business	3
BAN 840	Predictive Analytics for Business	3
BAN 550	Prescriptive Analytics for Business	3
Culminating Experience		
BAN 888	Implementing Analytics for Business	3

Marketing Analytics Option

(Offered through World Campus)

The aim of this option is to convey how marketing analytics are (1) applied within organizations, (2) conducted, and (3) meaningfully communicated and applied to business decision-making and strategy. The target market would be college graduates that desire to build their skills in marketing analytics functions, but may have little or no formal training in marketing analytics. The MAN option will be highly industry applicable, since it is aimed at giving students the core marketing analytics knowledge they will need to successfully apply marketing analytics in today's data-driven organizations.

Code	Title	Credits
Required Courses		
MKTG 811	Driving Business Success with Marketing Analytics	3
MKTG 812	Evaluating Marketing Communications in the Digital World	3
MKTG 813	Data-Driven Customer Acquisition & Retention	3
Culminating Experience		
MKTG 814	Analytics for Brand Management and Customer Experience	3

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The M.S. degree is an academic degree, which is strongly oriented toward research. To receive the Master of Science degree in Data Analytics, a student must complete at least 30 credits beyond the baccalaureate degree at the 400, 500, 600, or 800 level. At least 18 credits in the 500 and 600 series, combined, must be included in the program.

The program curriculum includes 15 credits of core courses, 9 credits of elective courses, and 6 credits of supervised research. The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School, and the student must pass a thesis defense.

Code	Title	Credits
Required Courses		
STAT 500	Applied Statistics	3
IE 575	Foundations of Predictive Analytics	3
SWENG 545	Data Mining	3
DAAN 501	Analytics Research and Problem Framing	3
DAAN 871	Data Visualization	3
Additional Courses		
An additional 9 credits of elective courses must be selected from the approved list of elective courses maintained by the graduate program office.		9
Thesis Research		
DAAN 600	Thesis Research ¹	6
Total Credits		30

¹ Students must take a minimum of 6 credits of DAAN 600.

The thesis work should be an in-depth investigation intended to extend the state of knowledge in some specialty area. For thesis guidelines and time lines, refer to the Penn State Graduate School website (<http://gradschool.psu.edu/current-students/etd/>).

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)

- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Refer to the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students in this program are not eligible for graduate assistantships.

Financial aid for students in on-campus programs is in the form of student loans and a limited number of small scholarships, as described on the Penn State Great Valley website (<https://greatvalley.psu.edu/tuition-and-financial-aid/>).

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Data Analytics (DAAN) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/daan/>)

Learning Outcomes

Master of Data Analytics (M.D.A.)

- COMMUNICATE:** Graduates will be able to effectively communicate technical knowledge, including ideas, data analysis, findings, or decision justification in written formats in a manner appropriate to the audience.
- APPLY/CREATE:** Graduates will be able to analyze large data sets to support data-driven decision making.
- KNOW:** Graduates will demonstrate their understanding of technologies used to develop, optimize, and deploy large-scale data analytics techniques.
- THINK:** Graduates will be able to discriminate between descriptive, diagnostic, predictive, and prescriptive analytics and the techniques used in each.
- PROFESSIONAL PRACTICE:** Graduates will demonstrate knowledge of and ability to practice the professional standards of engineering and professional behavior.

Master of Science (M.S.)

- COMMUNICATE:** Graduates will be able to effectively communicate technical knowledge, including ideas, data analysis, findings, or decision justification through oral presentations and writing.
- APPLY/CREATE:** Graduates will be able to formulate valid research questions and methods of inquiry to further the discipline of analytics and its application.
- KNOW:** Graduates will demonstrate understanding, and application in research, of machine learning and statistical analysis techniques.

4. **THINK:** Graduates will be able to discriminate and determine the application of descriptive, diagnostic, predictive, and prescriptive analytics, and the techniques used in each, to their research problems.
5. **PROFESSIONAL PRACTICE:** Graduates will demonstrate knowledge of and ability to practice the professional standards of analytics research and professional behavior.

Contact

Campus	Great Valley
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Adrian Sorin Barb
Program Contact	Sharon V. Patterson Penn State Great Valley 30 E. Swedesford Road Malvern PA 19355 svp40@psu.edu (610) 648-3318
Program Website	View (http://greatvalley.psu.edu/academics/masters-degrees/data-analytics/)

Campus	World Campus
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Adrian Sorin Barb
Program Contact	Sharon V. Patterson Penn State Great Valley 30 East Swedesford Road Malvern PA 19355 svp40@psu.edu (610) 648-3318
Program Website	View (https://www.worldcampus.psu.edu/degrees-and-certificates/data-analytics-base/overview/)

Demography

Graduate Program Head	Molly Martin
Program Code	DEMOG
Campus(es)	University Park
Degrees Conferred	Dual-Title
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=DEMOG)

Students electing this option through participating programs will earn a degree with a dual title at both the Ph.D. and M.A./M.S. levels, i.e., Ph.D. in (graduate program name) and Demography, or M.A. or M.S. in (graduate program name) and Demography.

The following graduate programs offer dual-title degrees in Demography:

- M.A. and Ph.D. in Anthropology and Demography
- M.A. and Ph.D. in Economics and Demography
- M.S. and Ph.D. in Energy, Environmental, and Food Economics, and Demography

- M.S. and Ph.D. in Health Policy and Administration and Demography
- M.S. and Ph.D. in Human Development and Family Studies, and Demography
- M.S. and Ph.D. in Rural Sociology and Demography
- M.A. and Ph.D. in Sociology and Demography

The Demography dual-title degree program option is administered by the Demography Program Committee, which is responsible for management of the program. The committee maintains program definition, identifies faculty and courses appropriate to the option, and recommends policies and procedures for its operation to the dean of the Graduate School. This dual-title degree program is offered as an option to graduate major programs in three colleges Agricultural Sciences, Health and Human Development, and the Liberal Arts. The option enables students from diverse graduate programs to attain and be identified with the content, techniques, methodology, and policy implications of demography, while maintaining a close association with areas of application. Through demography, students study:

1. the size, composition, and distribution of the population;
2. changes in these characteristics;
3. the processes that determine these changes—fertility, migration, and mortality; and
4. their social, economic, and cultural causes and consequences.

Admission Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

To pursue a dual-title degree in Demography, the student must apply to the Graduate School and be admitted to one of the following graduate programs: Anthropology, Economics, Energy, Environmental and Food Economics, Health Policy and Administration, Human Development and Family Studies, Rural Sociology, or Sociology.

Students applying for admission to the dual-title in Demography must provide a positive recommendation by a Demography Graduate Faculty member in their graduate major program.

Applicants should have a junior/senior cumulative grade-point average of well above 3.00 (on a 4.00 scale) and appropriate courses in statistics and in the social science department to which they are applying. The application should include three letters of reference and a statement describing and explaining the applicant's interest in demography and goals during and after graduate study. Doctoral students must apply and be admitted to the Demography dual-title program prior to taking the qualifying exam.

Degree Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

To qualify for a dual-title degree, students must satisfy the requirements of the graduate program in which they are enrolled, including the communication/foreign language requirements, if any. In addition, they must satisfy the minimum requirements for the dual-title in Demography described here, as established by the Demography Program Committee.

Within this framework, final course selection is determined by students and their degree committees. All dual-title degree candidates who are in residence must enroll in DEMOG 590 for 1 credit each year in residence.

Master's Degrees

For the M.A. and M.S. degree with the Demography option, 12 course credits are required in addition to the colloquium credit or credits. A minimum of 3 credits is required in each of the following areas:

1. disciplinary perspective courses;
2. demographic methods courses (SOC 573 is required of all students);
3. seminars in demographic processes;
4. seminars in population studies.

The courses that satisfy the area requirements can be chosen from a list of approved courses maintained by the graduate program office.

Particular courses may satisfy both the graduate major program requirements and those of the Demography option. The thesis supervisor must be a member of the Graduate Faculty recommended by the chair or the graduate officer of the program granting the degree and a member of the Demography faculty.

DoctorAL Degrees

For the Ph.D. degree with a dual-title in Demography, a minimum of 24 credits is required in addition to the colloquium credits. For students entering with a master's degree from another institution, equivalent course credits may be accepted. The following minimum number of credits is required in each curriculum category:

- 3 credits of disciplinary perspective courses;
- 6 credits of demographic methods courses;
- SOC 573 is required of all students;
- 6 credits of seminars in demographic processes;
- 3 credits of seminars in population studies;
- and 6 credits of electives.

Final course selection is determined in consultation with the Ph.D. committee.

The qualifying examination committee for the dual-title Ph.D. degree must include at least one Graduate Faculty member from the Demography program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both the primary graduate degree program and Demography. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the chair and at least one additional member of the Ph.D. committee must be members of the Graduate Faculty in Demography. The Demography faculty members on the student's committee are responsible for administering an examination in demography that constitutes a portion of the comprehensive examination of the dual-title doctoral student. Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in both their primary graduate program and Demography. Upon completion of the

doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

Requirements listed here are in addition to requirements for minors in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

A Ph.D. minor in Demography is available for doctoral students in graduate programs other than the dual-title participating programs who find it advantageous to include demographic content, methods, and policy analysis in their program of study. The student's Ph.D. committee must approve the choice of this minor, and one member of the Ph.D. committee must be from the Demography Graduate Faculty.

To qualify for a minor in Demography, students must satisfy the requirements of their graduate major program and take at least 15 credits in demography in addition to colloquium credits. A minimum of at least 6 credits must be at the 500 level. A minimum of at least 3 credits each in:

1. disciplinary perspective,
2. demographic methods courses (SOC 573 (<https://bulletins.psu.edu/search/?P=SOC%20573>) is required of all candidates),
3. seminars in demographic processes, and
4. seminars in population studies is required.

Students must enroll in DEMOG 590 (<https://bulletins.psu.edu/search/?P=DEMOG%20590>) for 1 credit during each year enrolled in the program and in residence.

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

In addition, the following awards typically have been available to graduate students in this program: Affiliated departments and The Population Research Institute Assistantships, and the NICHD Traineeship awards.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Demography (DEMOG) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/demog/>)

Contact

Campus	University Park
Graduate Program Head	Molly Martin
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Molly Martin
Program Contact	Cheryl Mohr cam84@psu.edu (814) 863-3069

Ecology

Graduate Program Head	Jason Kaye
Program Code	ECLGY
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Dual-Title Ph.D. in Ecology and Biogeochemistry Dual-Title Ph.D. and M.S. in Ecology and International Agriculture and Development Dual-Title Ph.D. in Microbiome Sciences
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=ECLGY)

This intercollege program emphasizes the properties of ecosystems by focusing on interactions of single organisms, populations, and communities with their environment. It is designed to give students an advanced understanding of ecological theory and hypothesis testing and is complementary to other environmental programs that emphasize the human role in ecosystems.

The program is administered by a committee drawn from faculty members in several departments and colleges of the University. The Program Chair is appointed by the dean of the Graduate School. The instructional staff is composed of participating faculty in those departments offering graduate courses in fields closely allied to ecology.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

GRE scores are not required for admission. Applicants should have a strong science background, including chemistry through organic chemistry, mathematics through calculus, physics, and biology. A limited number of such courses can be made up while the student is pursuing graduate studies.

Students with a background in another discipline that has potential value to original ecological work will be seriously considered. A junior/senior grade-point average of 3.00 or better (on a 4.00 scale) is required.

Students are strongly urged to choose their research interests and initiate communication with the relevant faculty member(s) before applying for admission. A student will not be admitted without the commitment of a

faculty member to serve as the student's research adviser. Teaching and research assistantships are available mainly through the student's faculty adviser.

The following are required:

1. three or more letters of recommendation regarding the student's academic and professional promise;
2. a concise statement describing the student's goals both within the program and in professional life;
3. a curriculum vitae.

Specific inquiries about the Ecology Program may be directed to the program chair. Applications received by December 1 will have preferred consideration for assistantships and fellowships for fall semester admission.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A minimum of 30 credits at the 400, 500, 600, or 800 level is required, with at least 18 credits at the 500 and 600 level, combined. A minimum of six (6) thesis research credits (ECLGY 600 or ECLGY 610) must be taken in Ecology.

In addition to Graduate Council requirements, the instructional program includes:

- ECLGY 515 Advances in Ecology (3 cr.),
- two graduate courses in ecology selected from the following subdisciplines: Molecular, Physiological, Behavioral, and Evolutionary Ecology; Population and Community Ecology; Ecosystem, Landscape and Global Ecology. A list of courses that will satisfy this requirement is maintained by the graduate program office,
- a graduate (500 or 800 level) statistics course,
- two credits of colloquium (ECLGY 590),
- a minimum of six thesis credits (ECLGY 600 or ECLGY 610),
- breadth courses selected by the student in consultation with the research adviser and research committee,
- and a thesis research project directed by the student's adviser. The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School, and the student must pass a thesis defense.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

In addition to Graduate Council requirements, the instructional program includes:

- ECLGY 515 Advances in Ecology (3 cr.),
- ECLGY 510 Classical Ecology (2 cr.)
- two graduate courses in ecology selected from the following subdisciplines: Molecular, Physiological, Behavioral, and Evolutionary Ecology; Population and Community Ecology; Ecosystem, Landscape

and Global Ecology. A list of courses that will satisfy this requirement is maintained by the graduate program office,

- two graduate (500 or 800 level) statistics courses,
- two graded credits plus two audit credits (4 credits total) of colloquium (ECLGY 590),
- breadth courses selected by the student in consultation with the research adviser and Ph.D. committee,
- one credit of Supervised Experience in College Teaching (ECLGY 602),
- a minimum of 15 thesis credits (ECLGY 600 or ECLGY 610),
- and a dissertation research project directed by the student's adviser.

English competence will be assessed and reported at the time of the qualifying examination and formally attested before the comprehensive examination is scheduled. The qualifying examination includes written and oral portions.

The Ph.D. committee is selected by the student and adviser and approved by the Program Chair and the Graduate School. The Ph.D. Committee must meet all Graduate Council Requirements (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>). In addition, members of the Ecology faculty must comprise at least half of the committee. The committee has the responsibility for determining the course program and research acceptable in satisfying degree requirements. The committee will administer the comprehensive examination and final oral examination.

Doctoral students must pass a qualifying examination, a comprehensive examination, and a final oral examination (the dissertation defense). To earn the Ph.D. degree, doctoral students must also write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Options

Four options for specialization are offered, for both the M.S. and the Ph.D.:

1. Conservation Biology
2. Microbial Ecology
3. Quantitative Ecology
4. Physiological Ecology

Students are not required to select an option. Each option entails extra course requirements plus a thesis directed by an ecology faculty member in the option.

When courses that fulfill option requirements appear on the list of approved subdiscipline courses, these courses may also be counted towards the subdiscipline graduate courses required for the Ecology major.

Conservation Biology

The Conservation Biology option is concerned with problems of maintaining the rapidly disappearing diversity of organisms and their habitats, and the global reservoir of genetic diversity that these organisms represent.

Code	Title	Credits
Required Courses		
Select two required courses from the following list:		
ANTH 559	Human Ecology	

BIOL 428	Population Genetics
GEOG 414	Principles and Applications in Landscape Ecology
WFS 430	Conservation Biology
In addition, two courses (at least 6 credits) are required from this list of Conservation Biology courses:	
ANTH 560	Ecology, Evolution, and Human Behavior
BIOL 414	Taxonomy of Seed Plants
BIOL 422	Advanced Genetics
BIOL 427	Evolution
BIOL 448	Ecology of Plant Reproduction
ENT 432	Insect Biodiversity and Evolution
ENT 457	Principles of Integrated Pest Management
FOR 508	Forest Ecology
FOR 530	Conservation Genetics
GEOG 411	Forest Geography
GEOG 587	Conservation GIS
WFS 462	Amphibians and Reptiles

Microbial Ecology

The Microbial Ecology option addresses the structure, function, and interactions of microbial populations and communities, both within plants and animal hosts and in diverse environmental samples (soils, sediments, water).

Code	Title	Credits
Required Courses		
Select two required courses from the following list:		
MICRB 401	Microbial Physiology and Structure	
MICRB 416	Microbial Biotechnology	
SOILS 512	Environmental Soil Microbiology	
PPEM 440	Introduction to Microbiome Analysis	
In addition, two courses (at least 6 credits) are required from this list of Microbial Ecology courses:		
BIOL/PPEM 425	Biology of Fungi	
BMB/MICRB 450	Microbial/Molecular Genetics	
CE 479	Environmental Microbiology for Engineers	
FDSC 526	Microbial Physiology of Foodborne Organisms	
GEOSC 409W	Geomicrobiology	
GEOSC 502	Evolution of the Biosphere	
MCIBS 593	Molecular Biology Laboratory	
PPATH 533	Molecular Genetics of Plant-Pathogen Interactions	
PPEM 454	Virus Ecology	
PPEM 456	Applied Microbial Ecology	
SOILS/CE 536	Topics in Biogeochemistry or GEOSC 53 Topics in Biogeochemistry	

Quantitative Ecology

The Quantitative Ecology option includes mathematical and statistical modeling and applications of statistics to experimental design and data analysis.

Code	Title	Credits
Required Courses		
Select two required courses from the following list:		

BIOL 465	Network analysis of biological systems
BIOL 519	Ecological and Environmental Problem Solving
WFS 560	Population Estimation and Modeling
WFS 585	Applied Spatial Ecology

In addition, two courses (at least 6 credits) are required from this list of Quantitative Ecology courses:

BIOL/STAT 555	Statistical Analysis of Genomics Data
FOR 455	Remote Sensing and Spatial Data Handling
GEOG 464	Advanced Spatial Analysis
GEOG 465	Advanced Geographic Information Systems Modeling
GEOC 450	Risk Analysis in the Earth Sciences
MATH 450	Mathematical Modeling
STAT 416	Stochastic Modeling
STAT 464	Applied Nonparametric Statistics
STAT 505	Applied Multivariate Statistical Analysis
STAT 508	Applied Data Mining & Statistical Learning
STAT 510	Applied Time Series Analysis
STAT 511	Regression Analysis and Modeling
STAT 512	Design and Analysis of Experiments
STAT 513	Theory of Statistics I
STAT 514	Theory of Statistics II
STAT 515	Stochastic Processes and Monte Carlo Methods
STAT 517	Probability Theory
STAT 551	Linear Models I
STAT 565	Multivariate Analysis

Physiological Ecology

The Physiological Ecology option is concerned primarily with the function and performance of organisms in their environment.

Code	Title	Credits
Required Courses		
Select two required courses from the following list:		
BIOL 406	Symbiosis	
BIOL 446	Physiological Ecology	
HORT 445	Plant Ecology	
PLBIO 514	Modern Techniques and Concepts in Plant Ecophysiology	

In addition, two courses (at least 6 credits) are required from this list of Physiological Ecology courses:

AGRO 410W	Physiology of Agricultural Crops
AGRO 518	Responses of Crop Plants to Environmental Stress
BIOL 415	Ecotoxicology
BIOL 441	Plant Physiology
ENT 539	Chemical Ecology of Insects
PLBIO 512	Plant Resource Acquisition and Utilization
PLBIO 513	Integrative Plant Communication and Growth
PLBIO 515	Modern Techniques and Concepts in Plant Cell Biology
PLBIO 516	Modern Techniques and Concepts in Plant Molecular Biology

Dual-Titles

Dual-Title Ph.D. in Ecology and Biogeochemistry

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Graduate students with research and educational interests in biogeochemistry may apply to the Biogeochemistry dual-title degree program. Students must apply and be admitted to the graduate program in Ecology and The Graduate School before they can apply for admission to the dual-title degree program. After admission to the Ecology program, students must apply for admission to and meet the admissions requirements of the Biogeochemistry dual-title program. Refer to the Admission Requirements section of the Biogeochemistry Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/biogeochemistry/>). Once a student has been admitted to the dual-title degree in Biogeochemistry, they must pass a qualifying examination that incorporates knowledge of the discipline of biogeochemistry.

It is preferred that students take a joint Ecology / Biogeochemistry qualifying examination incorporating knowledge of both the ecology and biogeochemistry disciplines. When a joint qualifying examination is administered, the qualifying examination committee will be composed of Graduate Faculty from Ecology and must include at least one Graduate Faculty member from the Biogeochemistry program.

Ecology graduate students who have already passed their qualifying examination will take a second qualifying examination focused solely on the discipline of biogeochemistry. When the Biogeochemistry qualifying examination is administered separately, faculty members who hold appointments in the Biogeochemistry Graduate Faculty may serve in administering the Biogeochemistry qualifying exam.

In either case, all qualifying examinations must be complete no later than the end of the fourth semester (not counting summer semesters) of entry into the Ecology program.

To qualify for the Biogeochemistry dual-title degree, students must satisfy the degree requirements for the Ph.D. in Ecology, listed in the Degree Requirements section. In addition, students must complete the degree requirements for the dual-title in Biogeochemistry, listed on the Biogeochemistry Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/biogeochemistry/>). Some courses may satisfy both the Ecology program requirements and those of the Biogeochemistry dual-title program.

In addition to the general Graduate Council requirements for Ph.D. committees (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>), the Ph.D. committee of an Ecology and Biogeochemistry dual-title Ph.D. student must include at least one member of the Biogeochemistry Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Biogeochemistry, the member of the committee representing Biogeochemistry must be appointed as co-chair. The Biogeochemistry representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D.

committee and reflects their original research and education in Ecology and Biogeochemistry. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title M.S. and Ph.D. in Ecology and International Agriculture and Development

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Graduate students with research and educational interests in international agriculture and development may apply to the International Agriculture and Development (INTAD) dual-title degree program. Students must apply and be admitted to the graduate program in Ecology and The Graduate School before they can apply for admission to the INTAD dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of INTAD dual-title program. Refer to the Admission Requirements section of the INTAD Bulletin page (p. 477).

Degree Requirements for dual-title M.S.

To qualify for the INTAD dual-title degree, students must satisfy the requirements of the Ecology M.S. program. In addition, they must satisfy the INTAD program requirements for the dual-title M.S. degree. Refer to the M.S. Degree Requirements section of the INTAD Bulletin page (p. 477). Some courses may satisfy both the Ecology program requirements and those of the INTAD dual-title program.

The Ecology program requires students pursuing a M.S. degree to produce a master's thesis. Therefore, in addition to the 12 credits specified in the degree requirements, dual-title students must write the thesis on a topic that reflects their education and interest in both Ecology and INTAD. At least 6 thesis research credits (ECLGY 600 or ECLGY 610) must be taken in Ecology.

All members of the student's committee for the dual-title M.S. degree will be members of the Graduate Faculty. The committee must include at least one Graduate Faculty member from INTAD. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role.

Degree Requirements for the Dual-Title Ph.D.

To qualify for the INTAD dual-title degree, students must satisfy the requirements of the Ecology Ph.D. program. In addition, they must satisfy the INTAD program requirements for the dual-title Ph.D. degree. Refer to the Ph.D. Degree Requirements section of the INTAD Bulletin page (p. 477). Some courses may satisfy both the Ecology program requirements and those of the INTAD dual-title program.

Qualifying Examination

It is preferred that students in the dual-title program take a single qualifying examination, containing elements of both Ecology and INTAD. However, in cases when students matriculate into a dual-title after they have already completed the Ecology qualifying exam, a second qualifying exam may be taken for the dual title, according to policy GCAC-604 (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-604-qualifying-exam/>) and the guidelines of the dual-title degree program. Whether taken as a combined exam in ECLGY and INTAD or a second, separate exam for INTAD, the qualifying

examination committee for the dual-title Ph.D. degree must include at least one Graduate Faculty member from the INTAD program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role.

Committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>), the Ph.D. committee of an Ecology and INTAD dual-title Ph.D. student must include at least one member of the INTAD Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in INTAD, the member of the committee representing INTAD must be appointed as co-chair.

Comprehensive Exam

At the end of their course work, students must pass a comprehensive examination that follows the guidelines established by the Ecology program and reflects both the Ecology program and the INTAD dual-title degree curriculum. International agriculture must be one of the key areas of the exam and the INTAD representative on the student's Ph.D. committee must have input into the development of and participate in the evaluation of the comprehensive examination.

Dissertation and Dissertation Defense

Doctoral students enrolled in the dual-title degree program are required to write and orally defend a dissertation on a topic that reflects their original research and education in both Ecology and INTAD. The dissertation should contribute to the body of knowledge in international agriculture. A public oral presentation of the dissertation is required. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School, and the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree.

DUAL-TITLE PH.D. IN ECOLOGY AND microbiome Sciences

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Ecology Ph.D. students with research and educational interests in Microbiome Sciences may apply for admission to the Microbiome Sciences Dual-Title Degree Program. Students must first apply and be admitted to the Ecology graduate and The Graduate School before applying for admission to the dual-title program. To apply, a student should send to the MBIOM Graduate Program Advisor (microbiomesciDT@psu.edu) a written personal statement that explains their interest in Microbiome Sciences; the career goals they hope to work toward by attaining the dual-title degree; and describe actual or potential research objectives that integrate microbiome sciences. This statement should be signed by their major adviser or dissertation adviser, if assigned. Students should also send the MBIOM Graduate Program Advisor their undergraduate and graduate transcripts for review by the MBIOM Faculty-in-Charge, who will notify the Graduate School and student about the enrollment decision.

The result of the ECLGY qualifying examination serves to qualify the student's entrance to the MBIOM dual-title program. The application for the dual-title degree program may be completed after the qualifying

examination in the major program, as long as the application takes place before the end of the fourth semester.

To obtain this dual-title, students must satisfy the degree requirements for the Ph.D. in Ecology, listed in the ECLGY Degree Requirements section. In addition, students must complete the degree requirements for the MBIOM dual-title, listed on the Microbiome Sciences Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/biogeochemistry/>). Students must complete a total of 15 credits including 2 credits of ECLGY 550 (<https://bulletins.psu.edu/search/?P=ECLGY%20550>) and at least 13 credits chosen in consultation with the adviser from an approved list of courses, with at least 3 credits in each of the following areas: Microbial Sciences, Ecology and Evolution, and Bioinformatics and Research Tools.. Eight of the 15 total credits must be taken at the 500-level. No more than six of the 15 total credits can be offered by the ECLGY program.

In addition to the general Graduate Council requirements for Ph.D. committees (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>), the Ph.D. committee of an Ecology and Microbiome Sciences dual-title Ph.D. student must include at least one member of the Microbiome Sciences Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Microbiome Sciences the member of the committee representing Microbiome Sciences must be appointed as co-chair. The Microbiome Sciences representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Ecology and Microbiome Sciences. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Ecology (ECLGY) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/eclgy/>)

Learning outcomes

Master of Science (M.S.)

1. **Know:** demonstrate knowledge of core principles and primary literature in their specialty area including comprehension of methods, results, and data analysis in the specialty area.
2. **Apply/Create:** demonstrate ability to design and carry out a major research project in the discipline, including synthesis of previous work in the field, and assembling findings into a written work.
3. **Think:** demonstrate ability to critically analyze work by others in their specialty area.
4. **Communicate:** demonstrate ability to convey scientific ideas and results in clear, concise and original writing as well as in formal oral presentations.
5. **Professional Practice:** demonstrate comprehension of and commitment to ethical standards in the discipline.

Doctor of Philosophy (Ph.D.)

1. **Know:** demonstrate knowledge of core principles and primary literature in their specialty area including comprehension of methods, results, and data analysis in the specialty area.
2. **Apply/Create:** demonstrate ability to design and carry out a major research project in the discipline, including synthesis of previous work in the field, and assembling new findings into a written work that advances understanding in the field.
3. **Think:** demonstrate ability to critically analyze work by others in their specialty area.
4. **Communicate:** demonstrate ability to convey scientific ideas and results in clear, concise and original writing as well as in formal oral presentations.
5. **Professional Practice:** demonstrate comprehension of and commitment to ethical standards in the discipline.
6. **Teach:** demonstrate the ability to teach key concepts of the discipline to students.

Contact

Campus	University Park
Graduate Program Head	Jason Philip Kaye
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Jared Gregory Ali
Program Contact	Jean Pierce 101 Life Sciences Bldg University Park PA 16802 jep32@psu.edu (814) 867-0371
Program Website	View (https://www.huck.psu.edu/graduate-programs/ecology/)

Economics

Graduate Program Head	Barry W. Ickes
Program Code	ECON
Campus(es)	University Park (Ph.D., M.A.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Arts (M.A.) Dual-Title M.A. and Ph.D. in Economics and Demography Dual-Title M.A. and Ph.D. in Economics and Operations Research Integrated B.A./B.S. in Economics and M.A. in Economics
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=ECON)

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Graduate study in Economics relies heavily on abstract mathematics. It is recommended that, at a minimum, applicants should have taken mathematics up through multivariate calculus.

We require that applicants take the 3-part general aptitude GRE. In judging applicants, we try to take into account that different applicants expend different amounts of effort in preparing for the GRE and that there are systematic differences among applicants from different countries. We require that the GRE be taken within 5 years prior to applying to our Ph.D. program.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

We place considerable weight on, and require three (3) letters of recommendation. Letters should be from people who know you well and who are familiar with graduate programs in Economics at leading

universities. The most valuable letters are from people who can credibly compare you to others who have succeeded in such programs.

Highly successful Ph.D. students in Economics display a wide variety of research skills, including creativity. The questions we ask on the application are intended to elicit information about those skills. Also, if you have completed a paper that displays such skills, upload it via the GRADS online application system.

Degree Requirements

Master of Arts (M.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The M.A. degree in economics may be earned by satisfactorily completing 30 credits of appropriate course work, presenting a master's essay, and passing a final oral examination. The master's essay includes preparation of a paper which is written under the supervision of a faculty member. A minimum of 30 credits at the 400, 500 or 800 level is required, with at least 18 credits at the 500 level.

Code	Title	Credits
Required Courses		
ECON 501	Econometrics	3
ECON 502	Microeconomic Analysis	3
ECON 503	Macroeconomic Analysis	3
ECON 510	Econometrics I	3
ECON 521	Advanced Microeconomic Theory	3
ECON 533	Applied and Quantitative Economics	3
ECON 596	Individual Studies	3
Electives		3
Culminating Experience		
ECON 530	Master's Scholarly Essay I	3
ECON 531	Master's Scholarly Essay II	3
Total Credits		30

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The Ph.D. program has 3 main parts taken in sequence: the core, subfields (of specialization), and the dissertation. Most students take 5 years to complete the program. Occasionally, but rarely, a student finishes in 4 years.

The Core

The core consists of 2 semesters of course work: a 2-semester sequence in microeconomic theory (ECON 502 Microeconomic Analysis and ECON 521 Advanced Microeconomic Theory), a 2-semester sequence in macroeconomic theory (ECON 503 Macroeconomic Analysis and ECON 522 Advanced Macroeconomic Theory), a 2-semester sequence in econometrics (ECON 501 Econometrics and ECON 510 Econometrics I), and a course in mathematics for economists (ECON 500 Introduction to Mathematical Economics).

At the beginning of the third semester, students are required to take 3-hour qualifying exams: one in microeconomics, one in macroeconomics, and one in econometrics. Students with prior graduate training may,

however, obtain permission to skip some of the course work in the core and take the qualifying exams earlier than the 3rd semester. Students in good academic standing may be allowed to substitute a qualifying research project for the 3 qualifying exams conditional on the approval of the DGS.

In their second year, all students must enroll in ECON 512A (1 credit offered in the fall). This course introduces students to computational methods used to numerically solve and simulate economic models and program econometric estimators. Also, all students in their second year must enroll in ECON 512B (2 credits offered in the spring semester). This course is a continuation of ECON 512A covering the modern computational methods used in both theoretical and empirical research in economics. Students will be required to work on a small project involving data analysis.

Subfields

Students must demonstrate competence in 3 subfields. Competence in a subfield is usually demonstrated by completing 6 credits in the subfield with no grade lower than a B. The department offers the following subfields:

- development economics
- econometrics
- game theory
- industrial organization
- international economics
- macroeconomics

With the permission of the student's adviser and the Director of Graduate Studies, a student may take a course that will count towards the subfield in another department. For instance, students have taken courses in Demography, Political Science, and Statistics.

3rd-Year Paper

Students must complete a paper by the end of their 5th semester, the fall semester of their 3rd year. The paper must be approved by a 3-person faculty committee. The paper must contain original research and must be written in a form suitable for submission to a journal. Students must attend the Knowledge Transfer course in the fall semester of their third year.

Dissertation Research

Most dissertations consist of several essays, each of which has the substance and quality of a journal article. However, a dissertation which has the substance and quality of a single major article in a leading journal is also acceptable. The comprehensive exam (dissertation proposal defense) must be completed before fall semester of 4th year. The student's Ph.D. committee will be nominated to the Graduate School prior to the comprehensive exam (typically this will occur more than 12 months after the qualifying exam).

The student will spend the 4th year and the beginning of the 5th year completing the dissertation and will use the summer after the 4th year and the beginning of the 5th year in preparation for the job market. The dissertation must be accepted by the Ph.D. committee, the Head of the Graduate Program, and the Graduate School, and the student must pass a final oral examination (the dissertation defense).

Good Standing

A student must remain in "good standing" while in the program. This means following the course sequence outlined above, maintaining a

GPA of at least 3.0 and completing the qualifying, third-year paper, and comprehensive exam requirements on time.

Dual-Titles

Dual-title M.A. and Ph.D. in Economics and Demography

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admissions Requirements

Students must apply and be admitted to the graduate program in Economics and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Demography dual-title program. Refer to the Admission Requirements section of the Demography Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/demography/>). Doctoral students must be admitted into the dual-title degree program in Demography prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Economics, listed in the Degree Requirements section. In addition, students must complete the degree requirements for the dual-title in Demography, listed on the Demography Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/demography/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Economics and must include at least one Graduate Faculty member from the Demography program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Economics and Demography. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of an Economics and Demography dual-title Ph.D. student must include at least one member of the Demography Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Demography, the member of the committee representing Demography must be appointed as co-chair. The Demography representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Economics and Demography. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be

accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-title M.A. and Ph.D. in Economics and Operations Research

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admissions Requirements

Students must apply and be admitted to the graduate program in Economics and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Operations Research dual-title program. Refer to the Admission Requirements section of the Operations Research Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>). Doctoral students must be admitted into the dual-title degree program in Operations Research prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Economics, listed in the Degree Requirements section. In addition, students must complete the degree requirements for the dual-title in Operations Research, listed on the Operations Research Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Economics and must include at least one Graduate Faculty member from the Operations Research program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Economics and Operations Research. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Economics and Operations Research dual-title Ph.D. student must include at least one member of the Operations Research Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Operations Research, the member of the committee representing Operations Research must be appointed as co-chair. The Operations Research representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Economics and Operations Research. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be

accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Integrated Undergrad-Grad Programs Integrated B.A./B.S. in Economics and M.A. in Economics

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.A./B.S. in Economics with the M.A. in Economics offered at the following campuses:

Undergraduate Degree

- University Park
- World Campus

Graduate Degree

- University Park

The graduate portion of this IUG is currently offered as face-to-face residential instruction. While the undergraduate curriculum for this IUG may be completed at multiple campuses, the ease and feasibility of completing the integrated program may be heavily dependent upon the location of the graduate instruction. Please discuss the feasibility of completing the IUG with a representative for the graduate program before beginning the application process.

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

Admissions Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The IUG program is a highly selective program and is appropriate only for those who are prepared to undertake a highly rigorous graduate study of economics. Applicants are subject to the same standards that are required of our applicants for the M.A. program. Students must apply to and meet admission requirements of the Graduate School, as well as admission requirements for the M.A. in Economics. Before applying to the Graduate School, students must have completed entrance to their undergraduate major, have completed no less than 60 credits, and be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree.

To apply to the program, students must:

- be economics majors by the time they apply for the IUG program and have completed at least 60 credits toward the B.A./B.S. degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.
- complete the requirements for a B.A./B.S. in economics with the following modifications: Two out of three prescribed courses for the B.A./B.S. must be taken at the honors-level. These prescribed

courses, which all count toward the undergraduate degree in economics are: ECON 302H, ECON 304H and ECON 306H. Knowledge of these courses are pre-requisites of the theoretical core of the Masters program. Regular versions of these courses are not adequate preparation for quality graduate programs in Economics. Students who have taken all the regular sections (non-honors) of these courses prior to their decision to pursue the IUG should audit at least two of these honors versions of the courses. Exceptions may be evaluated and approved by the faculty advisor of the IUG program.

- be on track to complete the undergraduate degree requirements within 4 years of initial matriculation.
- complete a Graduate School application for the M.A. program in Economics. Applicants will have to satisfy all the prerequisites that apply for admission to the M.A. program.
- provide two letters of reference and personal statement addressing the reasons for pursuing a graduate degree in Economics.
- prepare a plan of study identifying undergraduate credits to be applied to the M.A. degree elective requirements.
- submit GRE scores. We require that applicants take the 3-part general aptitude GRE. There is no minimum requirement for GRE scores. We take into account that different applicants expend different amounts of effort in preparing for the GRE and that there are systematic differences among applicants from different countries. GRE scores should not be more than five years old. Specifically, if you are applying for admission for the Ph.D. program beginning in the fall of year X, then you should have taken the GRE no earlier than the fall of year X-5.

Although the program has no fixed minimum grade -point average, an applicant is generally expected to have a minimum overall GPA of 3.5 (on a 4.0 scale) in undergraduate coursework and a minimum GPA of 3.5 in all coursework completed for the major.

Degree Requirements

Students must fulfill all degree requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Arts and Bachelor of Science in Economics are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). Degree requirements for the Master of Arts in Economics are listed on the Degree Requirements tab. Students must sequence their courses so that all undergraduate degree requirements are completed by the end of Year 4. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. If students accepted into the IUG program are unable to complete the M.A. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

In the semester in which the undergraduate degree requirements will be completed, IUG students must activate their undergraduate intent to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees. The courses that are eligible to double count for both degrees are:

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
ECON 501	Econometrics	3
ECON 502	Microeconomic Analysis	3

ECON 503	Macroeconomic Analysis	3
ECON 510	Econometrics I	3
ECON 521	Advanced Microeconomic Theory	3-6
ECON 533	Applied and Quantitative Economics	3

The double-counted credits could fulfill ECON 400-level course requirements for the B.A. or B.S. degrees and/or honors credit requirements. Elective courses must be taken at the ECON 500 or ECON 400 level. Courses below ECON 400 may not be counted towards the graduate degree requirements. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Academic Advising

The faculty designated to oversee the IUG program will provide general advice and monitor the progress of students in the IUG program to ensure that they achieve satisfactory performance and follow all relevant UFS and Graduate Council policies.

Advising is an important component of the integrated BA/BS/MA degree program. Upon acceptance into the program, each student will be assigned a faculty advisor whose academic specialty and/or area of research are as closely matched with the student's interest as possible. In consultation with the faculty adviser, the student will develop an individualized plan of study.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may

be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Economics (ECON) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/econ/>)

Learning Outcomes

1. CORE: Graduates will demonstrate broad knowledge and comprehension of the major macroeconomic and microeconomic models and econometric methodology.
2. FIELD: Graduates will acquire in-depth knowledge and comprehension of the major models, study designs and results of their specialty area.
3. RESEARCH: Graduates will be proficient in advancing knowledge in their specialty area through new approaches, models, methods, or the creative application of existing approaches, models and methods to produce new results.
4. TRANSFER: Graduates will learn to convey the major issues in their specialty area and their specific projects through research collaborations, discussions, presentations and publications.

Contact

Graduate Program Head: Barry W. Ickes

Director of Graduate Studies/Professor-in-Charge: Marc Henry

Ph.D. Program Contact

Primary Program Contact: Krista Winkelblech

Email: kfg106@psu.edu

Mailing Address: 515 Kern Graduate Building, University Park, PA 16802

Telephone: (814)865-1458

M.A. Program Contact

Primary Program Contact: Giselle Thompson

Email: glb6@psu.edu

Mailing Address: 503 Kern Graduate Building, University Park, PA 16802

Telephone: (814)863-1956

Ecosystem Management and Administration

Graduate Program Head	Margot Kaye
Program Code	EMGT
Campus(es)	World Campus (M.P.S.)
Degrees Conferred	Master of Professional Studies (M.P.S.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=facprog=EMGT)

The M.P.S. program in Ecosystem Management and Administration is designed to provide ecosystem and natural resources managers in a variety of fields a combination of leadership, business, and technical

skills that are critical for higher-level management and leadership positions. The program is designed to provide students with the training they need to cope with rapid changes in technology and management methodologies and provide them with the expanded expertise they will need as they progress in their careers. The program is designed to provide students with 1) essential skills in working with spatial data and using geographic information management systems; 2) a better understanding of how ecosystems are inventoried and monitored and the ability to analyze common natural resources data sets to support decision-making; 3) project planning and management skills, including knowledge of decision support systems commonly used in natural resources planning and management; 4) improved communication, conflict resolution, negotiation and leadership skills; 5) the ability to apply natural resources economics principles and cost-benefit analysis to common natural resources management problems; and 6) a deeper understanding of the legal and policy framework within which ecosystem management decisions are made.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Applicants must have undergraduate degree in forestry, wildlife or fisheries management, soils or water management, natural resources management, environmental science, ecology or related field. Scores from the Graduate Record Examinations (GRE) are required for admission. A student may be admitted at the discretion of the program without GRE scores.

Application materials should be submitted before February by those who want to begin in summer or fall and before September for those who want to begin in spring semester. For admission, an applicant should have at least a 2.75 overall grade-point average and a 3.00 junior/senior average (on a 4.00 scale). Three reference letters and a brief statement describing the applicant's academic goals, career interests, and special qualifications are required. The best-qualified applicants will be accepted up to the number of spaces available. Exceptions to admission requirements may be made for students with special backgrounds, abilities, and interests, at the discretion of the program.

Degree Requirements

Master of Professional Studies (M.P.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

A minimum of 30 credits at the 400, 500, or 800 level is required, with a minimum of 18 credits at the 500 or 800 level, and at least 6 credits at the 500 level.

Code	Title	Credits
Required Courses		
STAT 500	Applied Statistics	3
MANGT 510	Project Management	3
MANGT 520	Planning and Resource Management (optional) ¹	3
Select 3 credits from the following:		3
LEAD 555	Full Range Leadership Development	

OLEAD 409	Leadership Development: A Life-Long Learning Perspective	
OLEAD 410	Leadership in a Global Context	
OLEAD 411	Women and Leadership	
BA 865	Strategic Leadership	
BA 804	Ethical Leadership	
BA 888	Executive Leadership	
Select 3 credits from the following:		3
OLEAD 464	Communication Skills for Leaders in Groups and Organizations	
OLEAD 465	Collective Decision Making	
CAS 404	Conflict Resolution and Negotiation	
MGMT 565	Power and Influence	
BA 805	Negotiation Theory and Skills	
GEOG 482	Making Maps That Matter With GIS	3
EMGT 810	Ecosystem Monitoring	3
EMGT 820	Environmental Law and Policy	3
EMGT 830	Ecosystem Management, Planning, and Economics	3
Culminating Experience		
EMGT 894	Capstone Experience ¹	3-6
Total Credits		30

¹ Students who do not take MANGT 520 must take EMGT 894 for six credits.

The program culminates in a project completed while students are enrolled in EMGT 894. In conjunction with their academic adviser, students will select an ecosystem management topic or issue that they will independently investigate. Students will write a paper describing their investigation and conclusions. The paper will clearly describe the ecosystem management issue, review literature relevant to the issue, identify potential ways to address the issue, and evaluate the pros and cons of possible solutions.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Ecosystem Management (EMGT) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/emgt/>)

Contact

Campus	World Campus
Graduate Program Head	Margot Wilkinson Kaye
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Marc Eric McDill
Program Contact	Nicole Marie Houck nmh5631@psu.edu (814) 863-7221

Education

Graduate Program Head	Rayne Sperling
Program Code	EDUC
Campus(es)	World Campus (D.Ed.)
Degrees Conferred	Doctor of Education (D.Ed.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=EDUC)

The College-wide online Doctor of Education degree (D.Ed.) program is an inquiry-intensive, and practically oriented interdisciplinary degree program for professions in the education, counseling, and human services sectors. The program is designed to meet the needs of professional educators, counselors, leaders, and designers. The D.Ed. program offers a flexible degree option for students to engage in advanced research-oriented professional learning and practical application beyond the master's degree in an asynchronous format. It is ideal for students whose ability to enroll in existing residentially-based doctoral programs is limited. The program is designed to enroll professionals who seek to address problems of practice within their specific career contexts and offers students the freedom to build an appropriate doctoral degree program that centers on developing knowledge pertinent to problems of practice, while developing the inquiry skills and interdisciplinary practices necessary to develop, understand, and apply research to new problems and situations.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to

Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Applicants are expected to hold a master’s degree in education or closely related and relevant field (30 credits minimum) and to have completed at least three years of professional practice. Applicants are required to submit an application through the Graduate School that includes a program-specific essay describing the student’s interest in the program, three letters of academic and/or professional reference, and TOEFL/IELTS scores per Policy GCAC-305. Applicants are required to have demonstrated strong performance in their previous graduate programs based on their master’s transcripts. Graduate Record Examination (GRE) or other standardized test scores are not required for admission. Admitted students may be required to take additional course work as recommended at the time of admission. Students will provide a brief essay (up to 1,500 words) describing how their professional trajectory informs their academic goals.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

A minimum of 36 credits (post-master’s prerequisite) is required to complete the D.Ed. Students will be required to complete common core classes (18 credits), disciplinary specialization courses (minimum 12 credits), the residency requirement, and the Doctoral Capstone Project (minimum 6 credits, repeatable).

A. Common Core (18 credits). Completion of a set of common core courses designed specifically for the online D.Ed. students.

Code	Title	Credits
Required Courses		
EDUC 815	Foundations of Education Research	3
EDUC 801	Global Trends in Education Culture	3
EDUC 802	Educational Research Design	3
EDUC 804	Program Evaluation	3
EDUC 810	Quantitative Data Analysis Workshop	3
EDUC 811	Qualitative Data Analysis and Design	3

B. Content Specialization (minimum 12 credits). Content Specialization courses are intended to expand the student’s knowledge base to an area beyond the focus of their existing master’s degree. This requirement is intentional. To address problems of practice in contemporary society, practitioners are increasingly required to bring an interdisciplinary focus to identify, develop, and implement appropriate and practicable solutions.

Students will enroll in 12 or more credits of Content Specialization courses, dependent upon previous educational and professional certificates, degrees, and experiences. Selection of the Content Specialization courses will be determined in consultation with their program and faculty advisers and will coalesce with the focus of the student’s ensuing Doctoral Capstone Project (see

below). Students will be required to take the majority of this category of course work (9 credits) within a single thematic subspeciality.

The College of Education and other closely related M.Ed. degree programs delivered through World Campus currently offers a wide range of courses in which students may enroll. Given this extensive portfolio, it is not practical to list typical electives for all interested students.

C. Summer Summit Students will meet in person for a five-day summer summit at the University Park Campus to fulfill the residency requirement for online professional doctoral degree programs (see Policy GCAC-213 (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-213-residency-related-off-campus/>)). Each student will complete a minimum of one summit for the year(s) they attend. Students may complete the Residency at any time during their D.Ed. experience, with the strong recommendation that this be completed prior to their last year of their program (i.e., before enrollment in the majority of their credits for the capstone experience). The summer summit will engage students from all cohorts and include a series of workshops and professional development opportunities. In addition to addressing the residency requirement, the summer summit achieves two additional goals. First, the summit will enhance students’ understanding of issues in educational research by extending competencies developed in course work. Second, the summit will build community among students and faculty through academic engagement and social activities on campus.

D. Qualifying Examination For the qualifying examination, you will complete a portfolio that will be used to evaluate your past performance and potential for successfully completing the program. This exam is typically completed after the student has completed 9 credits but must be completed before the candidate completes 18 credits. According to graduate school policy (GCAC 704 (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-704-qualifying-examination-professional-doctorate/>)) you must:

- have a grade-point average of 3.00 or greater for work done at the University while a graduate student;
- have no incomplete or deferred grades;
- be in good academic standing and must be registered as a full-time or part-time graduate degree student for the semester (excluding summer session) in which the qualifying examination is taken.

E. Comprehensive Examination The comprehensive examination (See GCAC 706 (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-706-comprehensive-examination-professional-doctorate/>)) will take place after successfully passing the qualifying exam and the completion of the majority of course work but before you enroll in the Capstone Project course. The comprehensive examination must be scheduled within a year of completion of all required course work and no later than five years after passing the qualifying exam. To be eligible for the comprehensive examination you are required to have a minimum grade-point average of 3.00 for work completed at the University as a graduate student and may not have deferred or missing grades. Working with the Culminating Experience Adviser, students will submit a written project proposal (15-20 pages) to the adviser, identify the Professional Doctoral Committee (following) and present an oral presentation of the project proposal at an in-person intensive session. The project proposal will build on the area of interest paper submitted for the qualifying exam and will expand the literature reviewed and propose a concrete project, including research activities to be undertaken for the Capstone Project (GCAC-702 (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-702-professional->

doctoral-committee-composition/)). An online oral presentation given synchronously in an interactive format is also required. The project proposal will build on the area of interest paper submitted for the qualifying exam and will expand the literature reviewed and propose a concrete project, including research activities to be undertaken for the Capstone Project. The committee will evaluate the quality of the proposed project.

F. Doctoral Capstone Project (minimum 6 credits, repeatable). Completion of a research capstone experience is required for the D.Ed. The research capstone project is expected to address problems of practice and engage students, practitioners, or leaders in an educational setting, as relevant and appropriate to the student's interests. This capstone experience should be an independent effort by the student that extends beyond their course work and will result in a formal written document. It is intended to support the student in gaining a better understanding of, and possibly provide solutions to, a local problem of practice in the student's professional setting. Students will complete their capstone projects through the Research Practicum course (EDUC 894), which may be repeated for credit: EDUC 894 Doctoral level research practicum (initial 6 credits required and additional 1 credit required in all ensuing semesters until a successful defense of the project has been achieved). This experience will include support modules to benefit students as they complete their projects and degrees.

The final oral exam will be evaluated by the student's doctoral committee and consists of an oral presentation of the praxis research project by the candidate and a period of questions and responses. Questions will relate in large part to the praxis research project, but may cover the candidate's entire program of study, because a major purpose of the examination is also to assess the general scholarly attainments of the candidate. The portion of the examination in which the praxis is presented is open to the public and will be publicized and members of the academic community will be encouraged to attend.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://>

www.worldcampus.psu.edu/tuition-and-financial-aid/) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Education (EDUC) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/educ/>)

Learning Objectives

1. Demonstrate appropriate breadth and depth of knowledge related to education and learning, and comprehension of the major issues facing educational systems.
2. Use the disciplinary knowledge, methods and techniques of education to advance educational policy or practice.
3. Demonstrate effective teaching and communication skills for dissemination of educational findings and best practice to appropriate stakeholders.
4. Become a transformational educational leader who can improve or advocate for equitable learning outcomes for children, youths, families, and adults.
5. Participate and advance a culture of educational excellence through supporting lifelong learning within and across educational sectors.

Contact

Campus	World Campus
Graduate Program Head	Rayne Audrey Sperling
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	JOSEPH A. POLIZZI
Program Contact	Erica L Smith els6012@psu.edu
Program Website	View (https://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-doctor-of-education/)

Education Policy and Leadership

Graduate Program Head	Kevin Kinser
Program Code	EPL
Campus(es)	University Park (Ph.D.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Dual-Title Ph.D. in Educational Policy and Leadership and Comparative and International Education Dual-Title Ph.D. in Education Policy and Leadership and Transdisciplinary Research on Environment and Society Joint Ph.D. in Education Policy and Leadership and J.D. from Penn State Law
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=EPL)

The Education Policy and Leadership program provides doctoral training for students interested in career areas pertaining to educational policy, educational leadership, and higher education. The goal of the program is to prepare students to pursue careers and exert leadership in education as researchers, faculty, or administrators within educational organizations or other organizations that pertain to education. Students engage common coursework pertaining to education policy, leadership, research, equity, and diversity as well as specialized coursework that they select in consultation with their adviser to prepare themselves for the dissertation research that culminates their studies.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

All applicants must submit a resume, a statement of purpose, three letters of recommendation, and official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>).

GRE test scores are not required.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A minimum of 42 credits is required.

Code	Title	Credits
Required Courses		
EPL 501	Proseminar in Education Policy and Leadership	3
EPL 502	Educational Policy and Politics	3
EPL 503	Equity and Diversity in Education Policy and Leadership	3
EPL 504	Research Design in Education Policy and Leadership	3
Area of Emphasis Coursework		
	In consultation with their adviser, students will select 9 credits of coursework relating to one of three areas of emphasis: Educational Leadership, Educational Theory and Policy, and Higher Education.	9
Methodological Coursework		
	In consultation with their adviser, students will select 12 credits, with at least (a) one quantitative course (e.g., STAT 500 or EDPSY 406) and (b) one qualitative course (e.g., HIED 586).	12
Electives		
	In consultation with their adviser, students will select 9 credits of additional coursework.	9
Total Credits		42

In addition to the above course work, the Ph.D. degree requirements include successful completion of the following: a qualifying examination, English Competence requirements, a comprehensive examination, and a final oral examination (the dissertation defense). To earn the Ph.D. degree, doctoral candidates must write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-titles

DUAL-TITLE PH.D. IN COMPARATIVE AND INTERNATIONAL EDUCATION

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

ADMISSION REQUIREMENTS

Students must apply and be admitted to the graduate program in Education Policy and Leadership and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Comparative and International Education dual-title program. Refer to the Admission Requirements section of the Comparative and International Education Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/comparative-international-education/>). Doctoral students must be admitted into the dual-title degree program in Comparative and International Education prior to taking the qualifying examination in their primary graduate program.

DEGREE REQUIREMENTS

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Education Policy and Leadership. In addition, students must complete the degree requirements for the dual-title in Comparative and International Education, listed on the Comparative and International Education Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/comparative-international-education/>).

bulletins.psu.edu/graduate/programs/majors/comparative-international-education/). Some courses may satisfy both Education Policy and Leadership and Comparative and International Education degree requirements. Final course selection must be approved by the student's Ph.D. committee.

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Education Policy and Leadership and must include at least one Graduate Faculty member from the Comparative and International Education program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Education Policy and Leadership and Comparative and International Education. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of an Education Policy and Leadership and Comparative and International Education dual-title Ph.D. student must include at least one member of the Comparative and International Education Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Comparative and International Education, the member of the committee representing Comparative and International Education must be appointed as co-chair. The Comparative and International Education representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Education Policy and Leadership and Comparative and International Education. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

DUAL-TITLE PH.D. IN TRANSDISCIPLINARY RESEARCH ON ENVIRONMENT AND SOCIETY (TREES)

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-title-graduate-degree-programs/>).

ADMISSION REQUIREMENTS

Students must apply and be admitted to the graduate program in Educational Policy and Leadership and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the TREES dual-title program. Refer to the Admission Requirements section of the TREES Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/transdisciplinary-research-environment-society/>). Doctoral students should enroll in a dual-title graduate degree program early in their training, and no later than the end of the fourth semester (not counting summer semesters) of entry into the graduate major program.

DEGREE REQUIREMENTS

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Educational Policy and Leadership, listed in the Degree Requirements section. In addition, students must complete the degree requirements for the dual title in TREES, listed on the TREES Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/transdisciplinary-research-environment-society/>).

The qualifying examination for Educational Policy and Leadership will satisfy the qualifying exam requirement for the dual-title degree program in TREES. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>), the Ph.D. committee of an Educational Policy and Leadership and TREES dual-title Ph.D. student must include at least one member of the TREES Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in TREES, the member of the committee representing TREES must be appointed as co-chair. The TREES representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Educational Policy and Leadership and TREES. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Joint Degrees

JOINT PH.D. WITH PENN STATE LAW

Requirements listed here are in addition to requirements listed in GCAC-211 Joint Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-211-joint-degree-programs/>).

Penn State Law (PSL) and the Education Policy and Leadership (EPL) Program offer a joint degree program leading to a Doctor of Philosophy (Ph.D.) in Higher Education.

ADMISSION REQUIREMENTS

Applicants to the joint degree program must apply and be admitted first to Penn State Law, and subsequently to the Education Policy and Leadership graduate program. Admissions requirements and applications for admission for Penn State Law are listed in the J.D. Admissions (<https://pennstatelaw.psu.edu/penn-state-law-jd-admissions/>) section of the Penn State Law website. The admission requirements for the Education Policy and Leadership graduate program are listed on the Admission Requirements tab. When applying to the Education Policy and Leadership graduate program, applicants must include two letters of recommendation from Penn State Law faculty members and a career statement.

RESIDENCY

Students will normally spend six semesters in residence at Penn State Law and as many additional semesters in residence as needed to complete the additional requirements for the pertinent Education Policy and Leadership degree. Ph.D. candidates must arrange the sequence of semesters to ensure that they are in residence as full-time students in the EPL program for at least two consecutive semesters (Fall-Spring or Spring-Fall) excluding summer in a single twelve-month period.

DEGREE REQUIREMENTS

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the J.D. program are listed on the Penn State Law website (<https://pennstatelaw.psu.edu/jd-degree-requirements/>). Degree requirements for the Education Policy and Leadership Ph.D. degrees are listed on the Degree Requirements tab.

PENN STATE LAW

A maximum of twelve credits of Education Policy and Leadership course work may be double-counted for credit toward the J.D. degree at Penn State Law. Students must obtain a grade satisfactory to Penn State Law for the course work to be credited towards the J.D. degree. The following Education Policy and Leadership courses may qualify for credit in Penn State Law:

Code	Title	Credits
<i>Courses Eligible to Double Count for Both Degrees</i>		
EPL 503	Equity and Diversity in Education Policy and Leadership	3
EPL 504	Research Design in Education Policy and Leadership	3
EDLDR 542	Civil Rights and Education	3
EDLDR 573	Public School Finance	3
EDLDR 576	The Law and Education	3
EDTHP 516	Education and Demographic Change	3
EDTHP 518	Analysis of U. S. Educational Policy	3
EDTHP 520	Perspectives on Contemporary School Reform	3
EDTHP 533	Social History and Education Policy	3
HIED 552	Administration and Organization in Higher Education	3
HIED 560	Legal Issues in Higher Education and Student Affairs	3

EDUCATION POLICY AND LEADERSHIP

The courses that may be double-counted will be determined by the student's degree program and must fall within the limits set in GCAC-211 Joint Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-211-joint-degree-programs/>). Normally a maximum of twelve credits of Penn State Law coursework will be double-counted for the minimum requirements for an Education Policy and Leadership Ph.D. degree, subject to approval by the student's advisory committee.

SEQUENCE

The sequence of courses will be determined by the students and their advisers.

RECOMMENDED PROGRAM OF STUDY AND ADVISING

All students in the program will have two advisers, one from Penn State Law and one from Education Policy and Leadership. Periodic interaction between the two advisers is encouraged.

TUITION

Students will be charged the applicable Penn State Law tuition to cover the J.D. program and the applicable graduate tuition to cover the Education Policy and Leadership degree program. Penn State Law tuition will be paid for the semesters in which the student is registered for Penn State Law courses, and graduate tuition will be paid for the semesters in which the student is registered for graduate courses. A student may take up to one course (3 credit hours) per semester in the program where the student is not primarily registered without any change in tuition, but must pay additional tuition to the program that the student is not primarily registered if he or she wishes to take additional course work pursuant to that program during the semester.

FINANCIAL AID AND ASSISTANTSHIPS

Decisions on financial aid and assistantships will be made by each school according to that school's procedures.

FULFILLMENT OF DEGREE REQUIREMENTS AND GRADUATION

All courses in one program that will count toward meeting the requirements of the other program must be completed before the awarding of either degree. If students accepted into the joint degree program are unable to complete the J.D. degree, they are still eligible to receive the Education Policy and Leadership degree if all Education Policy and Leadership degree requirements have been satisfied.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **KNOW:** Demonstrate appropriate breadth and depth of general knowledge related to educational policy and leadership.
2. **COMMUNICATE:** Identify and communicate major factors, such as racism, shaping inequities in education and inhibiting the improvement and transformation of education in a society.
3. **APPLY/CREATE:** Utilize concepts and theories from education and other fields of inquiry in critically analyzing topics in education.
4. **THINK:** Conduct research that articulates an important and original question, analyzes relevant literature, employs appropriate methods and theory, and follows established standards of research ethics.
5. **PROFESSIONAL PRACTICE:** Apply knowledge and research findings to identify opportunities to improve education and reduce racial and other inequities within education.

Contact

Campus	University Park
Graduate Program Head	Kevin Kinser
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Kevin Kinser
Program Contact	Cassie Joyce Vomero cjm313@psu.edu (814) 865-1488
Program Website	View (https://ed.psu.edu/academics/departments/department-education-policy-studies/education-policy-and-leadership/)

Education, Development and Community Engagement

Graduate Program Head	Laszlo Kulcsar
Program Code	EDCE
Campus(es)	University Park (Ph.D., M.S., M.Ed.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Master of Education (M.Ed.) Dual-Title M.S. and Ph.D. in Education, Development, and Community Engagement and Comparative and International Education Dual-Title M.S. and Ph.D. in Education, Development, and Community Engagement and International Agriculture and Development Dual-Title M.S. and Ph.D. in Education, Development, and Community Engagement and Transdisciplinary Research on Environment and Society
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=EDCE)

The Education, Development and Community Engagement graduate program prepares graduates for employment in college and university programs, youth and family programming, state-level administration, local-level administration, private industry, and international education.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Master of education (M.Ed.)

All applicants must submit a letter of application, two or three pages in length, describing their professional experience, education, career goals, and reasons for pursuing the degree. Applicants must ensure that three recommendation and evaluation forms from individuals knowledgeable about the applicant are forwarded to the department. Only the most qualified applicants will be admitted to the graduate program. The graduate program may provisionally admit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/provisional-admission/>) selected applicants pending resolution of the requirements listed here. Exceptions to the admission criteria listed below may be made at the discretion of the program for students with special backgrounds, abilities, and interests.

Prerequisite for admission to a master's degree program is a demonstrated professional interest for employment in college and university programs, youth and family programming, state-level administration, local-level administration, private industry, and international education. Graduate Record Examination (GRE) scores are

required for application. The GRE score is one of several variables taken into consideration for offers of admission to the EDCE graduate program.

The purpose of the EDCE M.Ed. degree program is to prepare students through experience and course work in teaching, learning, and educational planning and assessment to enhance their professional qualifications and career advancement. Prerequisite for admission to this program is a minimum of 18 credits in professional education courses (including educational psychology and teaching and/or professional internship), or certification as a teacher of agriculture, or equivalent professional experience, including extension. Credits obtained to fulfill this admission prerequisite requirement cannot be applied towards requirements for the degree. The program is designed for individuals who are primarily interested in teaching. Graduates can go on to become: agricultural educators at the secondary or post-secondary level; Cooperative Extension educators or related professionals; and professionals in the public, private, or non-profit sectors focused on education, training, or human capacity development.

Students considering graduate education beyond the Master's level are encouraged to pursue the M.S. degree, which prepares students for advanced study and research activity.

Master of Science (M.S.)

All applicants must submit a letter of application, two or three pages in length, describing their professional experience, education, career goals, and reasons for pursuing the degree. Applicants must ensure that three recommendation and evaluation forms from individuals knowledgeable about the applicant are forwarded to the department. Only the most qualified applicants will be admitted to the graduate program. The graduate program may provisionally admit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/provisional-admission/>) selected applicants pending resolution of the requirements listed here. Exceptions to the admission criteria listed below may be made at the discretion of the program for students with special backgrounds, abilities, and interests.

Prerequisite for admission to a master's degree program is a demonstrated professional interest for employment in college and university programs, youth and family programming, state-level administration, local-level administration, private industry, and international education. Graduate Record Examination (GRE) scores are required for application. The GRE score is one of several variables taken into consideration for offers of admission to the EDCE graduate program.

The purpose of the EDCE M.S. degree program is to prepare students through experience and course work in research methods, data analysis, and research reporting to enhance their professional qualifications and career advancement. The program is designed for individuals who are primarily interested in conducting, interpreting, or communicating research for educational work or advanced graduate (i.e. doctoral) study. Graduates can go on to become: agricultural educators at the post-secondary level; Cooperative Extension educators or related professionals; and professionals in the public, private, or non-profit sectors focused on education, training, or human capacity development.

Doctor of Philosophy (Ph.D.)

Letter of Introduction and Résumé. Applicants must submit a two-to three-page letter of introduction in which they describe their professional experience and education and delineate their career goals. A current résumé is also required.

Graduate Record Examination. Graduate Record Examination (GRE) scores are required for application. The GRE score is one of several variables taken into consideration for offers of admission to the EDCE graduate program.

Official Transcripts. Official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>) must be submitted. Applicants must provide evidence of either a baccalaureate or a master's degree in the agricultural sciences, human sciences, or related area.

Three Letters of Reference.

Professional Experience. A minimum of two years of appropriate professional experience is required either prior to admission or before the degree is awarded. An interview with the graduate faculty is recommended of all applicants prior to admission into a doctoral program.

Degree Requirements

Master of Education (M.Ed.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

A program of study agreement between adviser and student, including planned course work (approved by the student's graduate committee) and time frame, should be completed before beginning the second semester of study.

The Master of Education degree requires a minimum of 31 credits at the 400, 500, or 800 level, with a minimum of 18 credits at the 500 or 800 level, and at least 6 credits at the 500 level. The 31 credits include:

Code	Title	Credits
Required Courses		
EDCE 501	Foundations of Education, Development, and Community Engagement	3
EDCE 509	Contemporary Research in Education, Development and Community Engagement	1-6
EDCE 590	Colloquium	1
EDCE 520	Scientific Method in the Study of Education, Development and Community Engagement	1-4
EDCE 521	Basic Applied Data Analysis in Education, Development and Community Engagement	1-4
	a 3-credit course focused on writing, public speaking, or communicating scientific information to an audience from a list maintained by the graduate program office	3
	9 credits in either the base program or one of two options defined in the Options section below	9
Electives		
	3 elective credits from a list maintained by the graduate program office	3

Culminating Experience

EDCE 596	Individual Studies (3 credits for the Capstone Project, EDCE 596 (3). A minimum of 3 credits of EDCE 596 is required, but the student's committee may require 3 additional credits be completed based on the project's complexity. No more than 3 credits of EDCE 596 will count towards the minimum credit requirement for the degree; if students are required to complete 6 credits of EDCE 596, then they must complete a minimum of 34 credits for the degree.)	3
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Total Credits **25-36**

In addition to completing a minimum of 31 credits of required course work, M.Ed. candidates are required to:

- Conduct a Capstone Project, typically involving the development and/or evaluation of an educational curriculum, project, or program;
- Write a professional paper supporting and reflecting upon the Capstone Project;
- Conduct an oral defense of the Capstone Project and professional paper; and
- Submit at least one article to an appropriate forum (e.g. extension- or education-related journal, trade publication, editor-only reviewed publication, or conference proceedings). At least one required submission must be in an applied publication via Extension or other applied outreach venue.

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A program of study agreement between adviser and student, including planned course work (approved by the student's graduate committee) and time frame, should be completed before beginning the second semester of study.

The Master of Science degree requires a minimum of 34 credits at the 400, 500, 600, or 800 level, with least 18 credits at the 500 and 600 level, combined, and a minimum of 6 credits of thesis research (600 or 610). The 34 credits include:

Code	Title	Credits
Required Courses		
EDCE 501	Foundations of Education, Development, and Community Engagement	3
EDCE 590	Colloquium	1
EDCE 520	Scientific Method in the Study of Education, Development and Community Engagement	3
EDCE 521	Basic Applied Data Analysis in Education, Development and Community Engagement	3
	a 3-credit course on Research Methods and Data Analysis from a list maintained by the graduate program office	3
	a 3-credit course focused on writing, public speaking, or communicating scientific information to an audience from a list maintained by the graduate program office	3
	9 credits in either the base program or one of two options defined in the Options section below	9

Electives

3 elective credits from a list maintained by the graduate program office	3
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Culminating Experience

EDCE 600	Thesis Research	6
or EDCE 610	Thesis Research Off-Campus	

Total Credits **34**

In addition to completing a minimum of 34 credits of required course work, M.S. candidates are required to:

- Conduct an empirical research study involving the collection of primary and/or secondary data;
- Write a thesis on their empirical research study;
- Conduct an oral defense of the research study and thesis; and
- Submit at least one article to a relevant peer-reviewed journal.

The thesis must be accepted by the committee members, the head of the graduate program, and the Graduate School, and the student must pass the thesis defense.

Options - M.S. and M.Ed. Programs

Students may elect to pursue either EDCE master's degree (M.S. or M.Ed.) as a generalist following a base curriculum or with one of two graduate options. Options involve more tailored course work and are included on the student's transcript and diploma after the primary degree title.

The **generalist (base)** curriculum educates students in core areas of EDCE, including leadership, formal education, non-formal program development, and evaluation. The base curriculum requires 9 credits of the following:

Code	Title	Credits
EDCE 505	Leadership Development	3
EDCE 525	Program Design and Delivery	3
EDCE 530	Teaching and Learning in Agricultural Science	3

The **Agricultural Education (AE) Option** allows students to select course work related to their specific interests including: educational program planning and instructional development; leadership within and administration of agricultural education programs; and change in agricultural education. The Agricultural Education option requires 9 credits, chosen from the following:

Code	Title	Credits
AEE 413	Program Planning and Instructional Development	3
EDCE 508	Administration and Supervision of Education, Development, and Community Engagement	3
EDCE 524	Change in Education, Development and Community Engagement	1-3
WFED 413	Vocational Education for Special-Needs Learners	3

The **Youth, Family, and Community (YFC) Option** allows students to select course work related to their specific interests including: program design, implementation, and evaluation; leadership development and civic engagement within communities; intergenerational programs; and volunteer program management. The Youth, Family, and Community option requires 9 credits, chosen from the following:

Code	Title	Credits
EDCE 535	Youth Civic Development	3
EDCE 550	Program Development and Evaluation in Youth, Families and Communities	3
EDCE 555	Volunteer Program Management	3
EDCE 845	Intergenerational Programs and Practices	3

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Approximately 32 credits of graduate work beyond the master’s degree are required. Approximately two-thirds of the total program must be in the major field. Courses in education or statistics may be counted in the major with prior approval of the Ph.D. committee. A minimum of 30 credits must be earned in residence.

Courses completed in the doctoral program in EDCE should give students competence in at least one core area of expertise: educational processes; leadership development and communications; program development, and research. Students must complete the following course requirements, for a minimum of 32 credits:

Code	Title	Credits
Required Courses		
EDCE 501	Foundations of Education, Development, and Community Engagement	3
EDCE 520	Scientific Method in the Study of Education, Development and Community Engagement	3
EDCE 521	Basic Applied Data Analysis in Education, Development and Community Engagement	3
EDCE 590	Colloquium (2 credits over two semesters)	2
Outreach and Engagement (12 500-level credits) – choose 3 credits from 4 for the following areas: Educational Processes, Leadership Development, Program Development, CEDEV, Civic Engagement. A list of courses that will satisfy these requirements is maintained by the program office.		12
Research (15 credits): Methods (6-9 credits), including EDCE 520, Research Methods, Qualitative, Mixed Methods, Others and Data Analysis (6-9 credits), including EDCE 521, EDCE 525, Basic, Advanced, Multivariate, Other. A list of courses that will satisfy these requirements is maintained by the program office.		3
Culminating Experience		
EDCE 600	Thesis Research (a minimum of 6 credits)	6
or EDCE 601	Ph.D. Dissertation Full-Time	
or EDCE 610	Thesis Research Off-Campus	
or EDCE 611	Ph.D. Dissertation Part-Time	
Total Credits		32

Doctoral students develop an appropriate program of study to meet these requirements in consultation with their adviser and Ph.D. committee.

Official entrance into the Ph.D. program occurs upon successful completion of the qualifying examination. Ph.D. degree requirements include successful completion of the following: approved graduate course work, English Competence requirements, a comprehensive examination, and a final oral examination (the dissertation defense). To earn the Ph.D. degree, doctoral candidates must write a dissertation that

is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

All doctoral students in EDCE are required to write an article or a paper for publication or presentation based upon (1) their dissertation or (2) their assistantship responsibilities as determined by the academic adviser and assistantship supervisor prior to the granting of a degree. The article or paper will be reviewed and approved by the student’s graduate adviser. The article or paper will be submitted to a refereed or professional journal, a professional or research conference, and/or a popular magazine. If co-authored with a faculty member, the student’s name will appear as the lead author.

Ph.D. Options

Students may elect to pursue either EDCE Ph.D. degree with one of three options:

Option 1: Leadership/Community Development

Graduates in this option pursue careers in community develop, government and non government organizations, leadership development and civic engagement within communities, intergenerational programs, and volunteer program management. This option requires 18-24 credits, chosen from the following:

Code	Title	Credits
EDCE 505	Leadership Development	3
EDCE 535	Youth Civic Development	3
AEE 440	Communication Methods and Media	3
AEE 460	Foundations in Leadership Development	3
AEE 465	Leadership Practices: Power, Influences, and Impact	3
AEE 508	Administration and Supervision of Education, Development, and Community Engagement	3
AEE 511	Youth Leadership Development	3
CED 445	International Development Practice	3
CED 417	Power, Conflict, and Community Decision Making	3
EDCE/CEDEV 505	Leadership Development	3
CEDEV 575	Methods and Techniques for Community and Economic Development	3
CEDEV 452	Community Structure, Processes and Capacity	3

Option 2: Program Development and Evaluation

The Program Development and Evaluation option allows students to select course work related to their specific interests including: program design, implementation, and evaluation. This option requires 18-24 credits, chosen from the following:

Code	Title	Credits
EDCE 525	Program Design and Delivery	3
EDCE 550	Program Development and Evaluation in Youth, Families and Communities	3
EDCE 555	Volunteer Program Management	3
EDCE 535	Youth Civic Development	3
EDCE 840	Applied Youth Development	3
EDCE 845	Intergenerational Programs and Practices	3

Option 3: Agricultural Education

The Agricultural Education option allows students to select course work related to their specific interests including: educational program planning and instructional development; leadership within and administration of

agricultural education programs; and change in agricultural education. This option requires 18-24 credits, chosen from the following:

Code	Title	Credits
EDCE 530	Teaching and Learning in Agricultural Science	3-4
EDCE 515	Engagement Through Outreach Scholarship in Higher Education	3
EDCE 524	Change in Education, Development and Community Engagement	1-3
AEE 400	Global Agriculture Education	3
AEE 412	Methods of Teaching Agriculture and Environmental Science	4
AYFCE 438	Living in an Increasingly Diverse Society	1-3
C-S 560	Principles of Instructional Supervision	3
LDT 505	Integrating Mobile Technologies into Learning Environments	3
LDT 550	Learning Design Studio	3
ADTED/CIED 508	Globalization and Lifelong Learning	3

Dual-Titles

Dual-Title M.S. and Ph.D. in Education, Development and Community Engagement and Comparative and International Education

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

M.S. and Ph.D. students with research and educational interests in schooling and education around the globe may apply to the dual-title program in Education, Development and Community Engagement (EDCE) and Comparative and International Education (CIED). Comparative and international education is a field devoted to the systematic analysis of the operation and effects of the world's education systems. The goal of the dual-title graduate program is to enable graduate students from EDCE to acquire the knowledge and skills of their primary area of specialization in EDCE, while at the same time gain the perspectives, techniques, and methodologies of comparative and international education. Graduate study in this program seeks to create opportunities for a range of people—administrators and policy makers in social welfare, health education, and development; school leaders; and scholars of education. Graduates of the dual-title program in EDCE and CIED will be able to compare, analyze, and make policy recommendations for agricultural and extension education at both national and international levels.

Admission Requirements

Students must apply and be admitted to the graduate program in EDCE and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the CIED dual-title program. Refer to the Admission Requirements tab on the CIED Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/comparative-international-education/>). Doctoral students must be admitted into the dual-title degree program in CIED prior to taking the qualifying examination in their primary graduate program.

Degree Requirements for the Dual-Title M.s.

To qualify for this dual-title degree, students must satisfy the requirements of the EDCE Master of Science degree program, listed on the Degree Requirements tab. In addition, they must satisfy the

CIED program requirements for the dual-title master's degree. Refer to the Degree Requirements tab on the CIED Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/comparative-international-education/>). Some courses may satisfy both the graduate primary program requirements and those of the CIED program. Final course selection is determined by the student after consulting, in advance, with their EDCE and CIED advisers.

For the dual-title M.S. degree in EDCE and CIED, the thesis must reflect the student's education and interest in both AEE and CIED. All members of the student's committee for the M.S. must be members of the Graduate Faculty. The master's committee must include at least one Graduate Faculty member from CIED. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. A Degree Committee form should be filed upon selection of the committee members.

Degree Requirements for the Dual-Title Ph.D.

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in EDCE, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual-title Ph.D. in CIED, listed on the CIED Bulletin page. (<http://bulletins.psu.edu/graduate/programs/majors/comparative-international-education/>)

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from EDCE and must include at least one Graduate Faculty member from the CIED program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both EDCE and CIED. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of an EDCE and CIED dual-title Ph.D. student must include at least one member of the CIED Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in CIED, the member of the committee representing CIED must be appointed as co-chair. The CIED representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in EDCE and CIED. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title M.S. and Ph.D. in Education, Development and Community Engagement and International Agriculture and Development

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

M.S. and Ph.D. students with research and educational interests in international agriculture extension and education may apply to the dual-title program in Education, Development and Community Engagement and International Agriculture and Development. The goal of the dual-title graduate program is to enable graduate students from EDCE to acquire the knowledge and skills of their primary area of specialization in EDCE, while at the same time gaining the perspective and methods needed to work internationally. Graduate study in this program seeks to prepare students to assume leadership roles in developing contemporary curricula and programs, conducting high-quality research and development activities, and disseminating new knowledge in these areas in both national and international settings. Students are required to write research proposals and expected to write grants to support their research activities reflecting both research areas of the dual-title degree. As part of their professional development presentations, publication of research articles and active participation in professional societies is expected. Emphasis is placed upon the professional development of the student.

Admission Requirements

Students must apply and be admitted to the graduate program in EDCE and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the INTAD dual-title program. Refer to the Admission Requirements section of the INTAD Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/international-agriculture-development/>). Doctoral students must be admitted into the dual-title degree program in INTAD prior to taking the qualifying examination in their primary graduate program.

Degree Requirements for the Dual-Title M.S.

To qualify for this dual-title degree, students must satisfy the requirements of the EDCE Master of Science degree program, listed on the Degree Requirements tab. In addition, they must satisfy the INTAD program requirements for the dual-title master's degree. Refer to the Master's Degree Requirements section of the INTAD Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/international-agriculture-development/>). Some courses may satisfy both the graduate primary program requirements and those of the INTAD program. Final course selection is determined by the student after consulting, in advance, with their EDCE and INTAD advisers.

For the dual-title M.S. degree in EDCE and INTAD, the thesis must reflect the student's education and interest in both EDCE and INTAD. All members of the student's committee must be members of the Graduate Faculty. The master's committee must include at least one Graduate Faculty member from INTAD. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. A Degree Committee form should be filed upon selection of the committee members and must be approved by the INTAD Academic Program Committee Co-chair.

Degree Requirements for the Dual-Title Ph.D.

To qualify for the dual-title degree, students must satisfy the degree requirements for the Ph.D. in EDCE, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual-title in INTAD, listed on the INTAD Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/international-agriculture-development/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from EDCE and must include at least

one Graduate Faculty member from the INTAD program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both EDCE and INTAD. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of an EDCE and INTAD dual-title Ph.D. student must include at least one member of the INTAD Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in INTAD, the member of the committee representing INTAD must be appointed as co-chair. The INTAD representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in EDCE and INTAD. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

DUAL-TITLE M.S. AND PH.D. IN EDUCATION, DEVELOPMENT, AND COMMUNITY ENGAGEMENT AND TRANSDISCIPLINARY RESEARCH ON ENVIRONMENT AND SOCIETY

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-title-graduate-degree-programs/>).

M.S. and Ph.D. students with research and educational interests in contemporary natural resource and societal changes may apply to the dual-title program in Education, Development, and Community Engagement (EDCE) and Transdisciplinary Research on Environment and Society (TREES).

The goal of the dual-title graduate program is to enable graduate students from EDCE to acquire the knowledge and skills of their primary area of specialization in EDCE, while at the same time gaining experience in creating engaged approaches to transdisciplinary scholarship. Graduate study in this program seeks to prepare students to draw upon materials from the biophysical, sociocultural, and sociodemographic arenas in an integrated, collaborative framework. Graduates of the TREES program are equipped with the ability to communicate effectively with stakeholders affected by natural resource and environmental change issues in public settings. Students are required to write research proposals for collaboration and are expected to write grants to support their transdisciplinary research activities reflecting both research areas of the dual-title degree. As part of their professional development presentations, publication of research articles and active participation in professional societies is expected. Emphasis is placed upon the professional development of the student.

ADMISSION REQUIREMENTS

Students must apply and be admitted to the graduate program in EDCE and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the TREES dual-title program. Refer to the Admission Requirements section of the TREES Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/transdisciplinary-research-environment-society/>). Doctoral students must be admitted into the dual-title degree program in TREES prior to taking the qualifying examination in their primary graduate program.

DEGREE REQUIREMENTS FOR THE DUAL-TITLE M.S.

To qualify for this dual-title degree, students must satisfy the requirements of the EDCE Master of Science degree program, listed on the Degree Requirements tab. In addition, they must satisfy the TREES program requirements for the dual-title master's degree. Refer to the Master's Degree Requirements section of the TREES Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/transdisciplinary-research-environment-society/>). Some courses may satisfy both the graduate primary program requirements and those of the TREES program. Final course selection is determined by the student after consulting, in advance, with their EDCE and TREES advisers.

For the dual-title M.S. degree in EDCE and TREES, the thesis must reflect the student's education and interest in both EDCE and TREES. All members of the student's committee must be members of the Graduate Faculty. The thesis supervisor and chair of the student's committee shall be a member of EDCE and TREES. Upon selection of the committee members, the committee should be officially appointed via the current outlined process from the Graduate School and must be approved by the TREES Academic Program Committee Co-chair.

DEGREE REQUIREMENTS FOR THE DUAL-TITLE PH.D.

To qualify for the dual-title degree, students must satisfy the degree requirements for the Ph.D. in EDCE, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual-title in TREES, listed on the TREES Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/transdisciplinary-research-environment-society/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from EDCE and must include at least one Graduate Faculty member from the TREES program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both EDCE and TREES. The qualifying examination for EDCE will satisfy the qualifying exam requirement for the dual-title degree program in TREES. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of an EDCE and TREES dual-title Ph.D. student must include at least one member of the TREES Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty

may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in TREES, the member of the committee representing TREES must be appointed as co-chair. The TREES representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in EDCE and TREES. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Agricultural and Extension Education (AEE) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/aee/>)

Applied Youth, Family and Community Education (AYFCE) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/ayfce/>)

Contact

Campus	University Park
Graduate Program Head	Laszlo Kulcsar
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Mark A Brennan
Program Contact	Kayla Sgobba 201E Armsby Building AESE - Penn State University Park PA 16802 kam6227@psu.edu (814) 867-0285
Program Website	View (https://bulletins.psu.edu/graduate/programs/majors/agricultural-extension-education/)

Educational Leadership

Graduate Program Head	Kevin Kinser
Program Code	EDLDR
Campus(es)	University Park (Ph.D., D.Ed., M.Ed.) World Campus (M.Ed.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Doctor of Education (D.Ed.) Master of Education (M.Ed.) Dual-Title Ph.D., D.Ed., and M.Ed. in Comparative and International Education Joint J.D./Ph.D., D.Ed., or M.Ed. with Penn State Law
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=EDLDR)

Graduate work in the Educational Leadership program encompasses two major career paths. The first path focuses on those who want to engage in a wide variety of leadership roles within and directly affecting schools and districts. These roles include, but are not limited to: teacher leadership, instructional leadership, principal leadership, and district-level leadership. This path may also lead to certification through the Pennsylvania Department of Education for the principalship and/or a letter of endorsement in the superintendency. The second path focuses on those who want to exercise leadership roles in educational policy arenas and/or engage in educational research. Possible roles include: intermediate unit officials, state and federal agency administrators and staff, professors of educational administration, and research and development personnel. The Principle Certificate is also available at Penn State Harrisburg.

The Educational Leadership program offers degree programs in residence at the University Park campus, and also offers the M.Ed. program along with Principal Certificate and Teacher Leadership Certificate programs online through World Campus.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate->

[admissions/how-to-apply/](#)). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The Educational Leadership program requires all graduate program applicants to submit:

- three letters of recommendation,
- official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>),
- a statement of purpose,
- a writing sample, and
- a current resume or curriculum vita.

Applicants must present evidence of at least a 3.0 grade-point average in the last two years of undergraduate work. A grade-point average of 3.50 in prior graduate work is required of those desiring admission to enter a doctoral program. The best-qualified students will be accepted up to the number of spaces available. Special backgrounds and experiences may allow for conditional admission to those not meeting stated criteria, at the discretion of the program.

Applicants are required to submit a writing sample. Applicants should submit a writing sample that reviews and critiques an academic article related to education leadership or education policy that affects education leaders.

Official scores from the GRE, the Miller Analogy Test, or the Law School Admissions Test (LSAT) from within the last 5 years are required for admission to doctoral programs.

Degree Requirements

Master of Education (M.Ed.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

All candidates for the M.Ed. degree will complete a minimum of 30 credits, with at least 18 credits at the 500 or 800 level, and at least 6 credits at the 500 level. M.Ed. students also must complete a capstone project/internship as described below.

The three designated emphases for the Educational Leadership M.Ed. are Teacher Leadership, School Leadership, and General Leadership.

Teacher Leadership (Online)

Code	Title	Credits
Required Courses		
EDLDR 859	Planned Change for School Improvement	3
EDLDR 861	Principles of Instructional Leadership	3
EDLDR 801	Introduction to Teacher Leadership	3
EDLDR 802	How Schools Work	3
500- or 800-Level Selected Course in EDLDR		3
500- or 800-Level Selected Course in EDLDR		3
500-Level Selected Course in EDLDR		3
500- or 800-Level Open Graduate Elective		3
500-Level Open Graduate Elective		3
Culminating Experience		

EDLDR 894	**SPECIAL TOPICS** (Capstone Inquiry Course - Capstone Project)	3
Total Credits		30

A total of 30 course credits, including EDLDR 894, are required. Further, 18 credits are required at the 500 level or higher, with six credits of selected courses in Educational Leadership and six credits of open elective credits. In total, at least six selected/elective credits must be taken specifically at the 500 level.

The final course (EDLDR 894) is a project-based course that represents the culmination of academic work toward the M.Ed. degree. Course requirements involve the development of a final capstone project focused on evaluation, analysis, or application of concepts first introduced and developed over the course of the student's M.Ed. program. The project should be planned in coordination with an EDLDR faculty member who agrees to serve as the student's adviser for this project and must reflect an appropriate degree of graduate-level scholarship, as determined by the adviser.

School Leadership (Online)

Code	Title	Credits
Required Courses		
EDLDR 841	Data Informed Leadership	3
EDLDR 859	Planned Change for School Improvement	3
EDLDR 861	Principles of Instructional Leadership	3
EDLDR/C-S 551	Curriculum Design: Theory and Practice	3
EDLDR 480	Introduction to Educational Leadership	3
EDLDR 831	Leadership for Equity and Diversity	3
EDLDR 868	The Principalship for Aspiring School Leaders	3
EDLDR 876	Law and Education for Educational Leaders	3
EDLDR 873	Money and Schools: Perspectives, Finance Policies, and Leadership	3
Culminating Experience		
EDLDR 595	Internship (Capstone Project)	3
Total Credits		30

A total of 30 course credits, including EDLDR 595, are required. Further, 18 credits are required at the 500 level or higher, with at least six credits to be taken specifically at the 500 level.

The final course (EDLDR 595) is a project-based course that represents the culmination of academic work toward the M.Ed. degree. Course requirements involve the development of signature assessments focused on evaluation, analysis, or application of concepts first introduced and developed over the course of the student's M.Ed. program. The project should be planned in collaboration with an EDLDR faculty member who agrees to serve as the student's adviser and with a school principal who agrees to serve as the student's mentor for this project and must reflect an appropriate degree of graduate-level scholarship, as determined by the program.

General M.Ed. (Residential)

Code	Title	Credits
Required Courses		
EDLDR 480	Introduction to Educational Leadership	3
EDLDR 532	Educational Leadership Doctoral Pro-seminar	3
500- or 800-Level Selected Course in EDLDR Strand ¹		3
500- or 800-Level Selected Course in EDLDR Strand ¹		3

500- or 800-Level Selected Course in EDLDR Strand ¹	3	
500- or 800-Level Selected Course in EDLDR Strand ¹	3	
500- or 800-Level Selected Course in EDLDR Strand ¹	3	
500- or 800-Level Selected Course in EDLDR Strand ¹	3	
500- or 800-Level Selected Course in EDLDR Strand ¹	3	
Culminating Experience		
EDLDR 596	Individual Studies (Master's Paper)	3
Total Credits	30	

¹ See EDLDR Graduate Student Handbook.

A total of 30 course credits, including EDLDR 596, are required. Further, 18 of those credits are required specifically in Educational Leadership courses. Students should select 18 credits from 6 of the 7 EDLDR strands listed in the handbook.

The final course (EDLDR 596) is a project-based course that represents the culmination of academic work toward the M.Ed. degree. Course requirements involve the development of a final capstone project focused on evaluation, analysis, or application of concepts first introduced and developed over the course of the student's M.Ed. program. The project should be planned in coordination with an EDLDR faculty member who agrees to serve as the student's adviser for this project and must reflect an appropriate degree of graduate-level scholarship, as determined by the adviser.

Doctor of Education (D.Ed.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Expectations of candidates for both the D.Ed. and Ph.D. are high in the field of research competence and require the ability to identify and conceptualize a research problem for the thesis. The D.Ed. is more appropriate for those with career goals in administration and policy making. The Ph.D. is more appropriate for those with career goals in research and scholarship.

A minimum of 90 credits is required for the D.Ed., of which at least 30 credits must be earned in residence at the University Park campus. A maximum of 30 credits from a completed master's degree earned at an institution that does not grant a doctorate in the student's major program may be accepted towards this minimum, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>). A maximum of 60 credits beyond the baccalaureate from an institution that grants the doctorate in the student's major program may be accepted towards this minimum, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>).

The 90 required credits, including transfer credits, must be earned in the following:

- Major Field (48 cr.): In the Major Field Area, D.Ed. students are required to take a minimum of 48 credits in Educational Leadership courses and courses related to the graduate major field. These courses should be selected in consultation with the student's adviser from a list of areas of concentration and courses that have been approved by the program to fulfill this requirement. If approved, transfer credits may be used to fulfill a portion of this requirement.

- Minor or General Studies Group (15 cr.): A graduate minor can be taken in any approved graduate degree program offered at Penn State, or in one of the approved stand-alone minors. A general studies group may include up to 6 credits taken as part of previous master's degree. These courses must be taken outside the EDLDR program. Selection of these courses should be done in close consultation with the student's academic adviser.
- Special Education Focused Course (3 cr.): a minimum of 3 credits concerning special education issues in a course approved by the program to fulfill this requirement.
- Research (9 cr.):
 - 3 credits of quantitative research
 - 3 credits of qualitative research
 - 3 credits of research design or advanced research methods
- Dissertation Research (15 cr.): EDLDR 600 or EDLDR 610.

Doctoral students must pass a qualifying examination, a comprehensive written and oral examination (the proposal defense), and a final oral examination (the dissertation defense). To earn the D.Ed. degree, doctoral students must also write a dissertation that is accepted by the doctoral committee, the head of the graduate program, and the Graduate School.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Expectations of candidates for both the D.Ed. and Ph.D. are high in the field of research competence and require the ability to identify and conceptualize a research problem for the thesis. The D.Ed. is more appropriate for those with career goals in administration and policy making. The Ph.D. is more appropriate for those with career goals in research and scholarship.

A minimum of 36 credits is required for the Ph.D.:

- EDLDR Course Work (15 cr.): A minimum of 15 credits chosen in conjunction with the student's academic adviser from a list of areas of concentration and courses that have been approved by the program to fulfill this requirement.
- Research Course Requirements (12 cr.):
 - A 3-credit course with statistical focus up to multivariate inference
 - A 3-credit course with focus on qualitative research methods
 - A 3-credit advanced course in either of the above areas (including course work in Mixed Methods)
 - EDLDR 585 Research Design: Implications for Decisions in Higher Education
- Supporting Field (9 cr.): A minimum of 9 credits selected from outside of the EDLDR program. All supporting field courses should be at the 500-level or above; however, appropriate 400-level courses may be approved by the adviser. As noted above, a student may choose to have research as a supporting field and substitute additional research courses to fulfill this requirement.

Ph.D. students may not enroll in more than 6 credits of independent study.

Doctoral students must pass a qualifying examination, a comprehensive written and oral examination (the proposal defense), and a final oral examination (the dissertation defense). To earn the Ph.D. degree, doctoral

students must also write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Titles

Dual-Title M.Ed., D.Ed., and Ph.D. in Comparative and International Education

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Students must apply and be admitted to the graduate program in Educational Leadership and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Comparative and International Education dual-title program. Refer to the Admission Requirements section of the Comparative and International Education Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/comparative-international-education/>). Doctoral students must be admitted into the dual-title degree program in Comparative and International Education prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Educational Leadership. In addition, students must complete the degree requirements for the dual-title in Comparative and International Education, listed on the Comparative and International Education Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/comparative-international-education/>). Some courses may satisfy both Educational Leadership and Comparative and International Education degree requirements. Final course selection must be approved by the student's doctoral committee.

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Educational Leadership and must include at least one Graduate Faculty member from the Comparative and International Education program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Educational Leadership and Comparative and International Education. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for doctoral committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the doctoral committee of an Educational Leadership and Comparative and International Education dual-title Ph.D. student must include at least one member of the Comparative and International Education Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the doctoral committee is not also a member of the Graduate Faculty in Comparative and International Education, the member of the committee representing Comparative and International Education must be appointed as co-chair. The Comparative and International Education representative on the student's doctoral committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their doctoral committee and reflects their original research and education in Educational Leadership and Comparative and International Education. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the doctoral committee, the head of the graduate program, and the Graduate School.

Joint Degrees

Joint J.D. / M.Ed., D.Ed., or Ph.D. with Penn State Law

Requirements listed here are in addition to requirements listed in GCAC-211 Joint Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-211-joint-degree-programs/>).

Penn State Law (PSL) and the Educational Leadership (EDLDR) Program offer a joint degree program leading to a Juris Doctor (J.D.); and either a Master of Education (M.Ed), a Doctor of Education (D.Ed) or a Doctor of Philosophy (Ph.D.) in Educational Leadership.

Admission Requirements

Applicants to the joint degree program must apply and be admitted first to Penn State Law, and subsequently to the Educational Leadership graduate program. Admissions requirements and applications for admission for Penn State Law are listed in the J.D. Admissions (<https://pennstatelaw.psu.edu/penn-state-law-jd-admissions/>) section of the Penn State Law website. When applying to the Educational Leadership graduate program, applicants must include two letters of recommendation from Penn State Law faculty members and a career statement. Applicants to the joint degree program may submit LSAT scores instead of GRE scores.

Residency

Students will normally spend four semesters in residence at the Law School and as many additional semesters in residence as needed to complete the additional requirements for the pertinent EDLDR degree. Ph.D. students must arrange the sequence of semesters to ensure that they are in residence as full-time students in the EDLDR program for at least two consecutive semesters (Fall-Spring or Spring-Fall) excluding summer in a single twelve-month period.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the J.D. program are listed on the Penn State Law website (<https://pennstatelaw.psu.edu/jd-degree-requirements/>).

PSL: A maximum of twelve credits for EDLDR course work may be double-counted for credit toward the J.D. degree at PSL. Students must obtain a grade satisfactory to PSL for the course work to be credited toward the J.D. degree. The following EDLDR courses may qualify for credit in PSL:

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
EDLDR 533	The Politics of Local School Districts	3
EDLDR 565		3
EDLDR 568	The Principalship	3
EDLDR 569	Decision Making in Educational Organizations	3
EDLDR 573	Public School Finance	3

EDLDR 576	The Law and Education	3
EDLDR 577	Law and Ethics in Education	3

EDLDR: The courses that may be double-counted will be determined by the student's degree program, and must fall within the limits set in GCAC-211 Joint Degree Programs (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-211-joint-degree-programs/>). Normally a maximum of twelve credits of PSL course work will be counted for credit for the minimum requirements for a master's degree, subject to approval by the student's advisory committee.

Sequence

The sequence of courses will be determined by students and their advisers.

Recommended Program of Study and Advising

All students in the program will have two advisers, one from PSL and one from EDLDR. Periodic interaction between the two advisers is encouraged.

Tuition

Students will be charged the applicable PSL tuition to cover the J.D. program and the applicable graduate tuition to cover the EDLDR degree program. PSL tuition will be paid for the semesters in which the student is registered for PSL courses, and graduate tuition will be paid for the semesters in which the student is registered for graduate courses. A student may take up to one course (3 credit hours) per semester in the program where the student is not primarily registered without any change in tuition, but must pay additional tuition to the program that the student is not primarily registered if he or she wishes to take additional course work pursuant to that program during the semester.

Financial Aid and Assistantships

Decisions on financial aid and assistantships will be made by each school according to that school's procedures.

Fulfillment of Degree Requirements and Graduation

All courses in one program that will count toward meeting the requirements of the other program must be completed before the awarding of either degree. If students accepted into the joint degree program are unable to complete the J.D. degree, they are still eligible to receive the EDLDR degree if all EDLDR degree requirements have been satisfied.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)

- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Educational Leadership Program (EDLDR) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/edldr/>)

Learning Outcomes

Master of Education (M.Ed.)

1. Demonstrate mastery of the student's specific program emphasis area, which includes knowledge of primary and secondary literature related to research methodologies, programmatic research priorities, and implications of that research for professional practice. Assessed through methods and theory coursework.
2. Students will design and carry out a research project that includes articulating an important and original question, analyzing appropriate literature, demonstrating conceptual and methodological creativity, and carrying out an original inquiry. Assessed through master's paper.
3. Demonstrate critical thinking about selected recent research in the program emphasis area through the description of an emerging scholarly theme/area, identification of specific publications that reflect it, and assessment of its strengths and weaknesses. Assessed through coursework and master's paper.
4. Demonstrate standards of field in written and oral communication by requiring research presentations in several courses.
5. Demonstrate knowledge and comprehension of research ethics issues including knowledge of ethical principles related to authorship, research reporting, data fabrication, plagiarism, conflicts of interest, peer review, data sharing and other areas of misconduct. Assessed through SARI examinations and participation.

Doctor of Education (D.Ed.)

1. Demonstrate mastery of the student's specific program emphasis area, which includes knowledge of primary and secondary literature related to research methodologies, programmatic research priorities, and implications of that research for professional practice. Assessed through candidacy and comprehensive exams (rubric).
2. Students will design and carry out a research project that includes articulating an important and original question, analyzing appropriate literature, demonstrating conceptual and methodological creativity,

and carrying out an original inquiry. Assessed through dissertation proposal and defense (rubric).

3. Demonstrate critical thinking about selected recent research in the program emphasis area through the description of an emerging scholarly theme/area, identification of specific publications that reflect it, and assessment of its strengths and weaknesses. Assessed through written and oral candidacy assessment (rubric).
4. Demonstrate standards of field in written and oral communication by (a) preparing a qualifying paper for Advancement to Doctoral Candidacy (b) preparing and presenting a written thesis proposal/comprehensive exam for the dissertation, and c) preparing and presenting the results of dissertation research in clear, concise oral presentations to an audience of peers. Assessed through qualifying paper, thesis proposal and dissertation defense.
5. Demonstrate knowledge and comprehension of research ethics issues including knowledge of ethical principles related to authorship, research reporting, data fabrication, plagiarism, conflicts of interest, peer review, data sharing and other areas of misconduct. Assessed through SARI examinations and participation in EPS 585 and 586.
6. Participate in conducting research with faculty, working on the boards of professional journals, teaching an undergraduate or graduate course, or other significant professional engagement as identified by the doctoral adviser. Assessed through faculty written evaluation, standardized assessment instruments, and/or other appropriate and clearly defined means.

Doctor of Philosophy (Ph.D.)

1. Demonstrate mastery of the student's specific program emphasis area, which includes knowledge of primary and secondary literature related to research methodologies, programmatic research priorities, and implications of that research for professional practice. Assessed through candidacy and comprehensive exams (rubric).
2. Students will design and carry out a research project that includes articulating an important and original question, analyzing appropriate literature, demonstrating conceptual and methodological creativity, and carrying out an original inquiry. Assessed through dissertation proposal and defense (rubric).
3. Demonstrate critical thinking about selected recent research in the program emphasis area through the description of an emerging scholarly theme/area, identification of specific publications that reflect it, and assessment of its strengths and weaknesses. Assessed through written and oral candidacy assessment (rubric).
4. Demonstrate standards of field in written and oral communication by (a) preparing a qualifying paper for Advancement to Doctoral Candidacy (b) preparing and presenting a written thesis proposal for the dissertation, and c) preparing and presenting the results of dissertation research in clear, concise oral presentations to an audience of peers. Assessed through qualifying paper, thesis proposal and dissertation defense.
5. Demonstrate knowledge and comprehension of research ethics issues including knowledge of ethical principles related to authorship, research reporting, data fabrication, plagiarism, conflicts of interest, peer review, data sharing and other areas of misconduct. Assessed through SARI examinations and participation in EPS 585 and 586.
6. Participate in conducting research with faculty, working on the boards of professional journals, teaching an undergraduate or graduate course, or other significant professional engagement as identified by the doctoral adviser. Assessed through faculty written evaluation,

standardized assessment instruments, and/or other appropriate and clearly defined means.

Professional Licensure/Certification

Many U.S. states and territories require professional licensure/certification to be employed. If you plan to pursue employment in a licensed profession after completing this program, please visit the Professional Licensure/Certification Disclosures by State (<https://www.psu.edu/state-licensure-disclosures/>) interactive map.

Contact

Campus	University Park
Graduate Program Head	Kevin Kinser
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Maria M Lewis
Program Contact	Mark Ivicic 200 Rackley Bldg. University Park PA 16802 mci104@psu.edu
Program Website	View (https://ed.psu.edu/academics/departments/department-education-policy-studies/educational-leadership-program/)

Campus	World Campus
Graduate Program Head	Kevin Kinser
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Maria M Lewis
Program Contact	Mark Ivicic 400 Rackley Bldg University Park PA 16802 mci104@psu.edu
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/educational-leadership-masters/overview/)

Educational Psychology

Graduate Program Head	Matthew McCrudden
Program Code	EDPSY
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Dual-Title Ph.D. and M.S. in Educational Psychology and Comparative and International Education
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=EDPSY)

The graduate program in Educational Psychology focuses on the study of learning, instruction, and measurement across the life span. The learning and instruction emphasis applies the study of cognitive psychology to research on learning and instruction in applied settings like schools. The course of study provides a strong foundation in psychological

theory, principles related to instructional applications, and quantitative methodology. The measurement emphasis applies cognitive psychology and theories of measurement to test design, instrument construction, scale analysis, and measurement theory. The Educational Psychology program emphasizes the use of rigorous quantitative methodology in the scientific study of learning, instruction, and measurement in applied settings. Typically this program prepares individuals for professions in universities, research institutions, government agencies, and industry. Individuals interested in more clinical applications of psychology, such as counseling psychology or school psychology should contact those specific graduate programs in the University.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

GRE scores are not required for admission. Typically applicants have at least a 3.0 junior/senior grade-point average (on a 4.0 point scale) and broad undergraduate background including college level mathematics. Exceptions may be made for students with special backgrounds, abilities, and interests. Applicants with a master's degree will be required to show strong performance in their graduate program. Applicants will also supply letters of reference and a written statement of their professional goals.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Students in the master's degree program are required to take 30 credits, including:

Code	Title	Credits
Required Courses		
EDPSY 421	Learning Processes in Relation to Educational Practices	3
EDPSY 450	Principles of Measurement	3
EDPSY 475	Introduction to Educational Research	3
EDPSY 505	Statistical Applications in Educational Research	3
Total Credits		12

The 30 credits must be at the 400, 500, 600, or 800 level, and at least 18 of those credits must be at the 500 and 600 level, combined. Students will also take at least one foundational course in educational theory, philosophy, or individual differences. The remaining credits will be taken in a way to develop the student's area of specialization, in consultation with the student's adviser. The program offers two pathways, M.S. with a thesis, and an M.S. without a thesis. Students wishing to go on to the Ph.D. are required to complete the M.S. with thesis.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Students in the doctoral degree program will select a major emphasis in either learning and instruction or measurement. Students in the doctoral program must complete the core required courses as listed in the Master of Science (M.S.) program. All students must also have at least one advanced-level course in learning and in measurement. Students will also have three courses spread across the foundational areas of:

1. educational theory and history,
2. philosophy,
3. and individual differences.

Students must pass a qualifying examination to enter into the doctoral program, assessing their mastery of the content in the core courses. Students must also pass a comprehensive examination assessing their areas of specialization near the end of their doctoral studies. Students are also expected to develop and defend a theoretically based scholarly research proposal that will become their dissertation project. The doctoral program culminates in the production of and defense of the student's dissertation that is expected to be a publishable quality independent research study.

Minor

Requirements listed here are in addition to requirements for minors in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

At the doctoral level, a minor is also possible in EDPSY. Like all doctoral minors, it requires at least 15 credits of work within the program; the specific requirements for the doctoral minor in Educational Psychology are EDPSY 421 (<https://bulletins.psu.edu/search/?P=EDPSY%20421>), EDPSY 450 (<https://bulletins.psu.edu/search/?P=EDPSY%20450>), and EDPSY 505 (<https://bulletins.psu.edu/search/?P=EDPSY%20505>), plus at least two other courses in EDPSY, in consultation with the minor adviser. The minor adviser should be a member of the Graduate Faculty and should be appointed to the student's Ph.D. committee as early as possible.

Dual-Titles

Dual-Title M.S. and Ph.D. in Educational Psychology and Comparative and International Education

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admissions Requirements

Students must apply and be admitted to the graduate program in Educational Psychology and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Comparative and International Education dual-title program. Refer to the Admission Requirements section of the Comparative and International Education Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/comparative-international-education/>).

international-education/). Doctoral students must be admitted into the dual-title degree program in Comparative and International Education prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Educational Psychology, listed in the Degree Requirements section. In addition, students must complete the degree requirements for the dual-title in Comparative and International Education, listed on the Comparative and International Education Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/comparative-international-education/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Educational Psychology and must include at least one Graduate Faculty member from the Comparative and International Education program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Educational Psychology and Comparative and International Education. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of an Educational Psychology and Comparative and International Education dual-title Ph.D. student must include at least one member of the Comparative and International Education Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Comparative and International Education, the member of the committee representing Comparative and International Education must be appointed as co-chair. The Comparative and International Education representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Educational Psychology and Comparative and International Education. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

All applicants are considered for Graduate Assistantships that are available in the program. Typically these assistantships provide tuition waiver plus a stipend.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Educational Psychology (EDPSY) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/edpsy/>)

Learning Outcomes

Master of Science (M.S.) - Thesis

1. Students demonstrate appropriate breadth and depth of knowledge in the science of learning.
2. Students demonstrate the ability to apply theory and methods in the science of learning to analyze educational contexts.
3. Students demonstrate the ability to evaluate and synthesize theory and methods in the science of learning to execute research.
4. Students demonstrate the ability to think critically and analytically about disciplinary knowledge in oral and written communication.
5. Students have knowledge of and conduct themselves according to ethical and professional standards.

Master of Science (M.S.) - Non-Thesis

1. Students demonstrate appropriate breadth and depth of knowledge in the science of learning.
2. Students demonstrate the ability to apply theory and methods in the science of learning to examine educational contexts.
3. Students demonstrate the ability to evaluate and synthesize theory and methods in the science of learning to generate educational applications.
4. Students demonstrate the ability to think critically and analytically about disciplinary knowledge in oral and written communication.
5. Students have knowledge of and conduct themselves according to ethical and professional standards.

Doctor of Philosophy

1. Students demonstrate appropriate breadth and depth of knowledge in the science of learning.
2. Students demonstrate the ability to apply theory and methods in the science of learning to generate novel insights into educational contexts.
3. Students demonstrate the ability to evaluate and synthesize theory and methods in the science of learning to generate novel hypotheses and research.
4. Students demonstrate the ability to think critically and analytically about disciplinary knowledge in oral and written communication.
5. Students have knowledge of and conduct themselves according to ethical and professional standards.

Contact

Campus	University Park
Graduate Program Head	P Karen Murphy
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Matthew T McCrudden
Program Contact	Corey Joseph Knight 125D CEDAR Building University Park PA 16802 cjk6403@psu.edu
Program Website	View (https://ed.psu.edu/academics/departments/departments-educational-psychology-counseling-and-special-education/educational-psychology/)

Educational Theory and Policy

Graduate Program Head	Kevin Kinser
Program Code	EDTHP
Campus(es)	University Park (Ph.D., M.A.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Arts (M.A.) Dual-Title M.A. and Ph.D. in Educational Theory and Policy and Comparative and International Education Integrated B.S. in Education and Public Policy and M.A. in Educational Theory and Policy Joint J.D. / Ph.D. or M.A. with Penn State Law
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=EDTHP)

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Scores from the Graduate Record Examinations (GRE) are required for admission. The best-qualified applicants will be accepted up to the number of spaces that are available for new students. Students with a 2.75 grade-point average will be considered for admission to the master's program, and with a 3.00 grade-point average at the master's level for the Ph.D. program. Exceptions to the minimum grade-point average may be made for students with special backgrounds, abilities, and interests, at the discretion of the program.

Degree Requirements

Master of Arts (M.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Candidates who seek an M.A. in Educational Theory and Policy shall complete programs that will include studies in social theory, policy, and planning or in the social sciences or humanities.

A minimum of 36 credits is required, with at least 18 credits in the 500 and 600 series combined, and a minimum of 6 credits of thesis research (EDTHP 600 or EDTHP 610).

Code	Title	Credits
Required Courses		
EDTHP 500	Proseminar in Educational Theory and Policy	3
<i>Research Methods</i>		
EDTHP 585	Research Design: Implications for Decisions in Higher Education	3
EDPSY 406	Applied Statistical Inference for the Behavioral Sciences (or another approved statistics course)	3
EDTHP 586	Qualitative Methods in Educational Research	3
Electives ¹		18
Culminating Experience		
EDTHP 600	Thesis Research	6
	or EDTHP 610 Thesis Research Off Campus	
Total Credits		36

¹ The elective credits may be chosen from a list of approved electives maintained by the program office.

Only 3 credits of EDTHP 596 may be counted toward the M.A.

A thesis is required. The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Candidates who seek a Ph.D. in Educational Theory and Policy shall complete programs that will include studies in social theory, policy, and planning, or in the social sciences or humanities.

A minimum of 57 credits is required:

Code	Title	Credits
Required Courses		
EDTHP 500	Proseminar in Educational Theory and Policy	3
<i>Research Methods</i>		
EDTHP 585	Research Design: Implications for Decisions in Higher Education	3
EDTHP 586	Qualitative Methods in Educational Research	3
6 additional credits approved by the program		6
<i>Theory Foundations</i>		
A minimum of 9 credits in 500-level EDTHP courses approved by the program		9
<i>Policy Foundations</i>		
EDTHP 587	Education Policy and Politics	3
6 additional credits approved by the program		6
<i>Focused Program of Study</i>		

A minimum of 9 credits in consultation with the adviser to prepare for dissertation research ¹

Electives	Credits
The remaining 15 elective credits may be chosen from a list of approved electives maintained by the program office.	15
Total Credits	57

¹ Students will need to explain how the three chosen courses will have prepared them for their dissertation research. This justification will become a part of the qualifying examination materials routed to all EDTHP faculty for approval. The course work must have a unifying theme. It does not have to be taken in the EDTHP program.

Doctoral students must pass a qualifying examination, a comprehensive written and oral examination, and a final oral examination (the dissertation defense). To earn the Ph.D. degree, doctoral students must also write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Titles

Dual-Title M.A. and Ph.D. in Comparative and International Education

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Students must apply and be admitted to the graduate program in Educational Theory and Policy and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Comparative and International Education dual-title program. Refer to the Admission Requirements section of the Comparative and International Education Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/comparative-international-education/>). Doctoral students must be admitted into the dual-title degree program in Comparative and International Education prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Educational Theory and Policy. In addition, students must complete the degree requirements for the dual-title in Comparative and International Education, listed on the Comparative and International Education Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/comparative-international-education/>). Some courses may satisfy both Educational Theory and Policy and Comparative and International Education degree requirements. Final course selection must be approved by the student's Ph.D. committee.

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Educational Theory and Policy and must include at least one Graduate Faculty member from the Comparative and International Education program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Educational Theory and Policy and Comparative and

International Education. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of an Educational Theory and Policy and Comparative and International Education dual-title Ph.D. student must include at least one member of the Comparative and International Education Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Comparative and International Education, the member of the committee representing Comparative and International Education must be appointed as co-chair. The Comparative and International Education representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Educational Theory and Policy and Comparative and International Education. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Integrated Undergrad-Grad Programs

Integrated B.S. in Education and Public Policy and M.A. in Educational Theory and Policy

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The Education and Public Policy (EPP) undergraduate program and the Education Theory and Policy (EDTHP) Master's program offer an integrated B.S./M.A. program that is designed for academically strong baccalaureate students in the EPP major to obtain both a B.S. in EPP and M.A. in EDTHP within five years of study. The first two years of undergraduate coursework include the University General Education requirements and prescribed lower level courses for EPP. In the third year, students focus on developing the self-selected portion of the EPP curriculum based on academic areas and themes of interest. The fourth year continues this self-selected undergraduate coursework in combination with graduate-level EDTHP courses, including the required pro-seminar (EDTHP 500). The fifth and final year of the program typically consists of graduate coursework in EDTHP and thesis research (6 credits) in consultation with the Master's thesis adviser. This interdisciplinary IUG allows students to define interests in the field of Education Policy and ultimately long-term academic and professional goals. For most students, the total time required for the Master's degree will be shortened by a year. The student will develop connections with graduate faculty and engage in the rigors of graduate study early on. The resources of the Graduate School are available for students accepted into the IUG program.

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate->

[admissions/how-to-apply/](https://gradschool.psu.edu/graduate-education-policies/)). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students must apply to the program via the Graduate School application for admission (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet all the admission requirements of the Graduate School and the EDTHP graduate program for the Master of Arts degree, listed in the Admission Requirements section. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. In consultation with an adviser, students must prepare a plan of study appropriate to this integrated program and must present their plan of study to the head of the graduate program or the appropriate committee overseeing the integrated program prior to being admitted to the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.

Students must fulfill all degree requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Science in Education and Public Policy are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). Degree requirements for the Master of Arts in EDTHP are listed on the Degree Requirements tab. Students are expected to sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students must complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.A. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
EDPSY 406	Applied Statistical Inference for the Behavioral Sciences	3
EDTHP 500	Proseminar in Educational Theory and Policy	3
EDTHP 585	Research Design: Implications for Decisions in Higher Education	3
EDTHP 586	Qualitative Methods in Educational Research	3

Joint Degrees

Joint J.D. / M.A. or Ph.D. with Penn State Law

Requirements listed here are in addition to requirements listed in GCAC-211 Joint Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-211-joint-degree-programs/>).

Penn State Law (PSL) and the Educational Theory and Policy (EDTHP) Program offer a joint degree program leading to a Juris Doctor (J.D.); and either a Master of Arts (M.A.) or a Doctor of Philosophy (Ph.D.) in Educational Theory and Policy.

Admission Requirements

Applicants to the joint degree program must apply and be admitted first to Penn State Law, and subsequently to the Educational Theory and Policy graduate program. Admissions requirements and applications for admission for Penn State Law are listed in the J.D. Admissions (<https://pennstatelaw.psu.edu/penn-state-law-jd-admissions/>) section of the Penn State Law website. The admission requirements for the Educational Theory and Policy graduate program are listed on the Admissions Requirement tab. When applying to the Educational Theory and Policy graduate program, applicants must include two letters of recommendation from Penn State Law faculty members and a career statement. Applicants to the joint degree program may submit LSAT scores instead of GRE scores. Students must be admitted to the program prior to taking the first course they intend to count towards the graduate degree.

Residency

Students will normally spend four semesters in residence at PSL and as many additional semesters in residence as needed to complete the additional requirements for the pertinent EDTHP degree. Ph.D. candidates must arrange the sequence of semesters to ensure that they are in residence as full-time students in the EDTHP program for at least two consecutive semesters (Fall-Spring or Spring-Fall) excluding summer in a single twelve-month period.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the J.D. program are listed on the Penn State Law website (<https://pennstatelaw.psu.edu/jd-degree-requirements/>). Degree requirements for the M.A. and Ph.D. degrees are listed in the Master's Degree and Doctoral Degree Requirements section.

PSL: A maximum of twelve credits for EDTHP course work may be double-counted for credit toward the J.D. degree at PSL. Students must obtain a grade satisfactory to PSL for the course work to be credited toward the J.D. degree. The following EDTHP courses may qualify for credit in PSL:

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
EDTHP 518	Analysis of U. S. Educational Policy	3
EDTHP 520	Perspectives on Contemporary School Reform	3
EDTHP 533	Social History and Education Policy	3
EDTHP 541	Contemporary Philosophies of Education	3
EDTHP 587	Education Policy and Politics	3

EDTHP: The courses that may be double-counted will be determined by the student's degree program. Normally a maximum of twelve credits of PSL course work will be double-counted for credit for the minimum

requirements for a master's or doctoral degree, subject to approval by the student's advisory committee.

Sequence

The sequence of courses will be determined by the students and their advisers.

Recommended Program of Study and Advising

All students in the program will have two advisers, one from PSL and one from EDTHP. Periodic interaction between the two advisers is encouraged.

Tuition

Students will be charged the applicable PSL tuition to cover the J.D. program and the applicable graduate tuition to cover the EDTHP degree program. PSL tuition will be paid for the semesters in which the student is registered for PSL courses, and graduate tuition will be paid for the semesters in which the student is registered for graduate courses. A student may take up to one course (3 credits) per semester in the program where the student is not primarily registered without any change in tuition, but must pay additional tuition to the program that the student is not primarily registered if he or she wishes to take additional course work pursuant to that program during the semester.

Financial Aid and Assistantships

Decisions on financial aid and assistantships will be made by each school according to that school's procedures.

Fulfillment of Degree Requirements and Graduation

All courses in one program that will count toward meeting the requirements of the other program must be completed before the awarding of either degree. If students accepted into the joint degree program are unable to complete the J.D. degree, they are still eligible to receive the EDTHP degree if all EDTHP degree requirements have been satisfied.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's

website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Educational Theory and Policy (EDTHP) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/edthp/>)

Learning Outcomes

Master of Arts (M.A.)

1. Demonstrate mastery of the student's specific program emphasis area, which includes knowledge of primary and secondary literature related to research methodologies, programmatic research priorities, and implications of that research for professional practice. Assessed through methods and theory coursework.
2. Students will design and carry out a research project that includes articulating an important and original question, analyzing appropriate literature, demonstrating conceptual and methodological creativity, and carrying out an original inquiry. Assessed through master's paper.
3. Demonstrate critical thinking about selected recent research in the program emphasis area through the description of an emerging scholarly theme/area, identification of specific publications that reflect it, and assessment of its strengths and weaknesses. Assessed through coursework and masters paper.
4. Demonstrate standards of field in written and oral communication by requiring research presentations in several courses.
5. Demonstrate knowledge and comprehension of research ethics issues including knowledge of ethical principles related to authorship, research reporting, data fabrication, plagiarism, conflicts of interest, peer review, data sharing and other areas of misconduct. Assessed through SARI examinations and participation in EDTHP 500.
6. Participate in conducting research with faculty, working on the boards of professional journals, or other significant professional engagement as identified by the master's adviser. Assessed through faculty written evaluation and/or other appropriate and clearly defined means.

Doctor of Philosophy (Ph.D.)

1. Demonstrate mastery of the student's specific program emphasis area, which includes knowledge of primary and secondary literature related to research methodologies, programmatic research priorities, and implications of that research for professional practice. Assessed through qualifying and comprehensive exams (rubric).
2. Students will design and carry out a research project that includes articulating an important and original question, analyzing appropriate literature, demonstrating conceptual and methodological creativity, and carrying out an original inquiry. Assessed through dissertation proposal and defense (rubric).
3. Demonstrate critical thinking about selected recent research in the program emphasis area through the description of an emerging

scholarly theme/area, identification of specific publications that reflect it, and assessment of its strengths and weaknesses. Assessed through written and oral candidacy assessment (rubric).

4. Demonstrate standards of field in written and oral communication by (a) preparing a research grant proposal for an award competition or an internal or external funding opportunity, and (b) presenting the results of dissertation research in clear, concise oral presentations to an audience of peers. Assessed through research/award proposal and dissertation defense.
5. Demonstrate knowledge and comprehension of research ethics issues including knowledge of ethical principles related to authorship, research reporting, data fabrication, plagiarism, conflicts of interest, peer review, data sharing and other areas of misconduct. Assessed through SARI examinations and participation in EDTHP 500.
6. Participate in conducting research with faculty, working on the boards of professional journals, teaching an undergraduate or graduate course, or other significant professional engagement as identified by the doctoral adviser. Assessed through faculty written evaluation, standardized assessment instruments, and/or other appropriate and clearly defined means.

Contact

Campus	University Park
Graduate Program Head	Kevin Kinser
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Mimi Schaub
Program Contact	Cassie Joyce Vomero 300 Rackley Building University Park PA 16802 cjm313@psu.edu (814) 865-1488
Program Website	View (https://ed.psu.edu/academics/departments/department-education-policy-studies/educational-theory-and-policy-program/)

Electrical Engineering (Capital)

Graduate Program Head	Vahid Motevalli
Program Code	EE (M.Eng.); EENG (M.S.)
Campus(es)	Harrisburg (M.S.) World Campus (M.Eng.)
Degrees Conferred	Master of Science (M.S.) Master of Engineering (M.Eng.) Integrated B.S. in Electrical Engineering and M.S. in Electrical Engineering
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=EENG)

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Master of engineering (M.Eng.)

A prospective graduate student in Electrical Engineering at Penn State Harrisburg must fulfill the admission requirements as set forth by Graduate Council, and have a bachelor of science degree in an electrical engineering program accredited by the Accreditation Board of Engineering and Technology (ABET), or the equivalent. An undergraduate cumulative grade-point average of 3.0 or better on a 4.0 scale is required for admission. Exceptions to this will be based on professional experience and other factors such as GRE scores. In addition, a student who does not meet the overall 3.0 grade-point average may be considered for admission if the student has a 3.0 junior/senior grade-point average. Up to 15 credits earned in three semesters or fewer, as a nondegree student, may be applied toward the master's degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>).

Those applying for admission as a Master of Engineering student without an electrical engineering degree may be admitted with the stipulation that deficiencies in background, if any, will be remedied early in the program and that these courses will be in addition to the required number of credits for the degree.

Applicants must submit the following:

- online Graduate School application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) and payment of the application fee
- official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>)
- test scores from the Graduate Record Examinations (GRE) (preferable, but not required)
- three (3) letters of reference, especially those from faculty who can evaluate academic potential
- a personal statement of technical interest, goals, and experience

Test scores from the Graduate Record Examination (GRE) are required ONLY for those applicants indicating interest in an assistantship. Assistantships are only available to students in residence.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Master of Science (M.S.)

Admission into the Master of Science (M.S.) Electrical Engineering program will be granted only to candidates who demonstrate high potential for success in graduate studies.

Applicants should have undergraduate degrees in engineering or technology-related fields from an accredited university and must meet the admission requirements as set by Penn State's Graduate Council.

An undergraduate cumulative grade-point average of 3.0 or better on a 4.0 scale, and scores from the GRE are required for admission.

Applicants must submit the following:

- a completed Graduate School online application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) with the application fee
- official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>)
- three (3) letters of professional recommendations from individuals who can evaluate the applicant's potential
- a personal statement of technical interest, goals, and experience
- test scores from the Graduate Record Examination (GRE)
- statement of interest in graduate assistantship, if desired

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Completed International Application material must be submitted by the following deadlines:

- May 31 for the fall semester
- September 30 for the spring semester
- February 28 for the summer session

Applications received after these deadlines will be processed for the following semester.

Degree Requirements

Master of Engineering (M.Eng.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

A total of 30 credits is required for a Master of Engineering degree, of which at least 21 must be taken through Penn State Harrisburg engineering graduate programs. Up to 9 credits of graduate work may be transferred from other institutions provided (a) credits are suitable for the particular engineering discipline, and (b) students have earned a grade of B or better, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>). At least 18 credits must be at the 500 level, which includes 3 credits of EE 594.

Students enrolled in the program for the Master of Engineering degree in Electrical Engineering must earn 9 credits in the required core courses (i.e., courses with the EE prefix).

Students must write a scholarly paper and present it before two faculty members. The paper, completed in EE 594, is intended to be a relatively short document that includes a relevant literature review on a selected research topic identified by the adviser and to be prepared in a prescribed format (e.g. as papers in IEEE Transactions).

Students must have a 3.00 grade-point average in both prescribed and supporting courses approved by the program to graduate. Students pursue the program on a part-time basis. A student may complete the program within two years, based on completion of two courses a semester.

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

All graduate students in Electrical Engineering are required to adhere to the requirements of the Graduate Council. The requirements of the Graduate Council, however, are minimum requirements and the policies, procedures, and regulations listed below are additional and more specific for graduate students pursuing the M.S. in Electrical Engineering degree at Penn State Harrisburg. Advisers will call pertinent regulations to the attention of their advisees, but it should be understood that it is the student's personal responsibility to see that all requirements are satisfied.

The MSEE program at Penn State Harrisburg is structured into two areas of concentration to fully take advantage of the specialty areas represented in the EENG Graduate Faculty. The areas are Electronics-Electromagnetics-Optics (EEO) and Systems.

The program requires 31 credits, including:

- 24 course credits with at least 15 credits at the 500 level,
- one colloquium credit,
- and 6 thesis credits (600-level).

All students are required to take a 500-level analysis course (EMCH 524A) in addition to prescribed courses in one of the two concentration areas. The prescribed courses are intended to establish the fundamentals of the technical areas. To incorporate some breadth into the program, students are required to take at least one course in the second concentration area. A maximum of three 400-level courses (9 credits) may be taken for the MSEE degree.

Original research, usually requiring at least two semesters of work (nominal 6 credits), is expected for a thesis. Students must write and submit a thesis. The thesis work should be an in-depth investigation intended to extend the state of knowledge in some specialty area. The thesis committee consists of three Graduate Faculty members, including the thesis adviser. For thesis guidelines and timelines, students are referred to the Penn State Graduate School web site (<http://gradschool.psu.edu/current-students/etd/>).

The EENG program has established a six-year time limit for completion of the M.S. degree. Any extension beyond six years requires the approval of the EENG program Graduate Faculty.

The student must maintain a minimum grade point average (GPA) of 3.00 or better on a 4.00 scale in 500- and 400-level courses listed on his/her Plan of Study.

Penn State Harrisburg's MSEE program is distinct and independent of the MSEE program offered at the University Park campus.

Integrated Undergrad-Grad Programs

Integrated B.S. in Electrical Engineering and M.S. in Electrical Engineering

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Electrical Engineering with the M.A. in Electrical Engineering offered at the following campuses:

- Harrisburg

Graduate Degree

- Harrisburg

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The Electrical Engineering program offers a limited number of academically superior Bachelor of Science candidates the opportunity to enroll in an integrated, continuous program of study leading to both the Bachelor of Science and the Master of Science in Electrical Engineering. The ability to coordinate as well as concurrently pursue the two degree programs enables students to earn the two degrees in five years.

Students in the IUG program must satisfy the degree requirements for both Bachelor of Science and Master of Science degrees. However, the total course load is reduced due to the maximum of 12 credits that can count towards both degrees. A minimum of 7 credits proposed to count for both degrees must be at the 500 level. Thesis credits may not be double counted. The fourth year of the IUG program differs from the fourth year of the Bachelor of Science program due to the courses that count toward the Master of Science Degree requirements.

Student performance will be monitored on an on-going basis. In addition, a formal evaluation of student's academic performance will be conducted at the end of the first semester of the senior year for a typical student in the program. Students who have not maintained a 3.4 GPA in their Math and Electrical Engineering courses will be put on probationary status with respect to the IUG program. Their ability to continue in the IUG program will be based on academic performance in the last semester of their senior year. As part of the review in the senior year, students will be advised about the thesis requirement in the graduate program.

If for any reason a student admitted to the IUG program is unable to complete the requirements for the Master of Science degree, the student will be permitted to receive the Bachelor of Science degree assuming all the undergraduate degree requirements have been satisfactorily completed. If students successfully complete courses listed in the recommended schedule, they will satisfy the requirements for the Bachelor of Science degree by the end of their fourth year.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students must apply to the program via the Graduate School application for admission (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet all the admission requirements of the Graduate School and the Electrical Engineering graduate program for the Master of Science degree, listed in the Admission Requirements section.

Students must submit:

Undergraduate Degree

- an official transcript
- three letters of professional recommendation from individuals who can evaluate the applicant's potential
- a personal statement of technical interest and goals

A faculty adviser will help undergraduate candidates determine a sequence of courses that will prepare them for acceptance into the Integrated Undergraduate-Graduate (IUG) degree program. In order to apply for this IUG program, students must have completed entrance to the undergraduate major and a minimum of 81 credits; therefore a typical student would apply after completing the fifth semester and before the end of the sixth semester. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. For consideration for acceptance into the program, students must have cumulative grade point average (GPA) of 3.4 or better and collective GPA of 3.4 or better in the following courses:

Code	Title	Credits
CMPEN 271	Introduction to Digital Systems	3
CMPEN 275	Digital Design Laboratory	1
EE 315	Electrical Signals and Circuits with Lab (or equivalent)	5
EE 341	Semiconductor Device Principles	3
CMPEH 472	Microprocessors	4
And all the designated MATH, PHYS, and CMPSC courses		

Applications will be evaluated based on students' overall academic performance, in addition to the above requirements. In all cases, admission to the program will be at the discretion of the Graduate Admissions Committee of the Electrical Engineering program.

Degree Requirements

Students must fulfill all degree requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Science in Electrical Engineering are listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>). Degree requirements for the Master of Science in Electrical Engineering degree are listed on the Degree Requirements tab. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

The EENG program has established a six-year time limit for completion of the M.S. degree. Any extension beyond six years requires the approval of the EENG program's Graduate Faculty.

Students must maintain a minimum grade point average (GPA) of 3.00 or better on a 4.00 scale in 500- and 400-level courses listed on their Plan of Study.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Electrical Engineering (EE) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/ee/>)

Learning Outcomes

1. **KNOW.** Graduates will be able to demonstrate broad mastery of core principles in electrical engineering as well as in-depth mastery in selected electrical engineering topics.
2. **CRITICAL THINKING.** Graduates will be able to critically and creatively conceptualize, evaluate and formulate electrical engineering problems, as well as perform the analyses required for problem definition.

3. **PROBLEM SOLVING.** Graduates will be able to apply advanced knowledge, techniques, skills and state of the practice tools to solve electrical engineering problems.
4. **COMMUNICATE.** Graduates will be able to effectively communicate, both orally and in writing, project outcomes, such as ideas, requirements, designs, analyses, findings, and justification for decisions.
5. **ETHICS AND PROFESSIONALISM.** Graduates will be able to demonstrate an understanding of professional and ethical responsibility and conduct themselves accordingly.

Contact

Campus	Harrisburg
Graduate Program Head	Vahid Motevalli
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Rafic A Bachnak
Program Contact	Kelly Batche W256 Olmsted 777 West Harrisburg Pike Middletown PA 17057 klb68@psu.edu (717) 948-4349
Program Website	View (https://harrisburg.psu.edu/science-engineering-technology/ee-eet/master-electrical-engineering-msee/)

Campus	World Campus
Graduate Program Head	Vahid Motevalli
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Robert A. Gray
Program Contact	Kelly Batche W256 Olmsted - Penn State Harrisburg 777 W. Harrisburg Pike Middletown PA 17057 klb68@psu.edu (717) 948-4349
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-electrical-engineering-masters-degree/overview/)

Electrical Engineering (Engineering)

Graduate Program Head	Madhavan Swaminathan
Program Code	EE
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Dual-Title Ph.D. and M.S. in Electrical Engineering and Operations Research
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=EE)

The general areas of graduate research in Electrical Engineering are electromagnetics and optics; electronics and photonics; communications, computers, networking, and signal processing; and control and power systems. Specializations available within these areas include:

- microwaves, antennas, and propagation;
- electro-optics and nonlinear optics;
- remote sensing and space systems;
- materials and devices;
- circuits and networks;
- VLSI;
- communications;
- networking;
- signal and image processing;
- computer vision and pattern recognition;
- control systems; and
- power systems.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Applicants are required to submit:

- GRE scores are optional (those choosing to submit GRE scores should submit to school code 2660),
- three letters of reference,
- a personal statement of relevant experience and goals,
- a resume,
- official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>),
- and a supplemental application.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

1. Thesis option—a total of 32 credits (at least 18 at the 500-and 600-level combined) including:
 - a. 24 credits in course work, with at least 12 credits in courses with the EE designation;
 - b. 2 colloquium credits (EE 500);
 - c. 6 thesis credits (EE 600 or EE 610);
 - d. and a thesis accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School;
2. Paper option—a total of 32 credits (at least 18 at the 500-level) including:
 - a. 27 credits in course work, with at least 14 credits in courses with the EE designation;

- b. 2 colloquium credits (EE 500);
- c. 3 paper credits (EE 594);
- d. and a satisfactory scholarly paper.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The communication requirement is met by adequacy in both spoken and written English. This is accomplished through testing and remedial course requirements. All doctoral students must pass a qualifying examination, a comprehensive examination, and a final oral examination. To earn the Ph.D. degree, doctoral students must also write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School. The qualifying examination consists of both written and oral parts; the oral comprehensive examination is preceded by the writing of a dissertation proposal. The program requires a minimum of 39 course credits and 2 colloquium credits (EE 500) beyond the B.S. degree.

Dual-Titles

Dual-title Ph.D. and M.S. in Electrical Engineering and Operations Research

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Students must apply and be admitted to the graduate program in Electrical Engineering and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Operations Research dual-title program. Refer to the Admission Requirements section of the Operations Research Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>). Doctoral students must be admitted into the dual-title degree program in Operations Research prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Electrical Engineering, listed in the Degree Requirements section. In addition, students must complete the degree requirements for the dual-title in Operations Research, listed on the Operations Research Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Electrical Engineering and must include at least one Graduate Faculty member from the Operations Research program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Electrical Engineering and Operations Research. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of an Electrical Engineering and Operations Research dual-title Ph.D. student must include at least one member of the Operations Research Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Operations Research, the member of the committee representing Operations Research must be appointed as co-chair. The Operations Research representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Electrical Engineering and Operations Research. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

In addition, the following awards typically have been available to graduate students in this program:

Paul F. Anderson Graduate Fellowship
 Melvin P. Bloom Memorial Graduate Fellowship
 Luther B. and Patricia A. Brown Graduate Fellowship
 Joseph R. and Janice M. Monkowski Graduate Fellowship

James R. and Barbara R. Palmer Fellowship
 Pontano Family Scholarship in Electrical Engineering
 Society of Penn State Electrical Engineers (SPSEE) Graduate Fellowship
 Fred C. and M. Joan Thompson Graduate Fellowship
 Bess L. and Mylan R Watkins Graduate Fellowship

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Electrical Engineering (EE) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/ee/>)

Contact

Campus	University Park
Graduate Program Head	Madhavan Swaminathan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	John F Doherty
Program Contact	Lisa Marie Timko 121 E E East University Park PA 16802 lmg183@psu.edu (814) 863-7294
Program Website	View (http://www.eecs.psu.edu/students/graduate/Graduate-Degree-Programs-EE.aspx)

Energy and Mineral Engineering

Graduate Program Head	Jeremy Gernand
Program Code	EME
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Dual-Title Ph.D. and M.S. in Energy and Mineral Engineering and Transdisciplinary Research on Environment and Society Dual-Title Ph.D. and M.S. in Energy and Mineral Engineering and Operations Research Integrated B.S. in Energy Business and Finance and M.S. in Energy and Mineral Engineering Integrated B.S. in Energy Engineering and M.S. in Energy and Mineral Engineering Integrated B.S. in Environmental Systems Engineering and M.S. in Energy and Mineral Engineering Integrated B.S. in Mining Engineering and M.S. in Energy and Mineral Engineering Integrated B.S. in Petroleum and Natural Gas Engineering and M.S. in Energy and Mineral Engineering
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=EME)

The John and Willie Leone Family Department of Energy and Mineral Engineering provides a vertically integrated approach to research and education in all aspects of the energy and mineral industries, including scientific and engineering issues, health and safety, and maintenance of high environmental standards. The department's mission is to forge an intellectual and scientific cohesiveness in energy and mineral resource technology. This objective is achieved by exploiting the natural synergy between the exploration, extraction, processing, and utilization of energy and mineral resources so as to cater to the emerging needs of society.

The Energy and Mineral Engineering (EME) program is a single graduate program with a focus on the production of energy and minerals in an economic, safe and efficient manner. The program provides flexible education of students in energy and mineral sciences and engineering, with focus on both non-renewable and renewable resource and energy industries. The program is designed to resolve the sometimes competing goals of flexible education of requisite breadth while still providing in-depth study; students are required to follow a focused curriculum that combines the requisite rigor with flexibility in a rapidly changing field of endeavor. Participating students take select from core program and required option courses and additional courses from a broad array of courses to meet the total credit requirements. Students are not required to choose an option and may complete the base program in EME. However, a student who desires disciplinary identity may choose from among the five following available graduate options:

- Petroleum and Natural Gas Engineering,
- Mining and Mineral Process Engineering,

- Fuel Science, and
- Energy Systems Engineering.

EME 551	Safety, Health and Environmental Risks in Energy and Mineral Production	3
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Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Scores for the Graduate Record Examinations (GRE) are required for admission. The best-qualified applicants will be accepted by the Energy and Mineral Engineering graduate program up to the number of spaces available for new students.

Admission to the Energy and Mineral Engineering graduate program is competitive. Entering students must hold a bachelor’s degree in a science or engineering discipline, unless they are admitted to the Integrated Undergraduate-Graduate (IUG) program. Students with 3.00 or better (out of 4.00) junior/senior cumulative grade-point averages and appropriate course backgrounds will be considered for admission. Exceptions to the minimum 3.00 grade-point average may be made for students with special backgrounds, abilities, and interests, at the program’s discretion. Letters of recommendation and an applicant’s statement of purpose are also required.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

All graduate students are expected to attend general Department seminars. Graduate students may be asked to contribute to the instructional programs of the Department by assisting with undergraduate laboratory and lecture courses.

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The M.S. degree program in Energy and Mineral Engineering is designed for students to gain advanced knowledge for research, analysis, and design in Energy and Mineral Engineering.

M.S. students must take at least two (2) courses (6 credits of core courses) from the list of prescribed (core) courses:

Code	Title	Credits
EME 501	Design Under Uncertainty in Energy and Mineral Systems	3
EME 511	Interfacial Physical-Chemical Systems, Processes, and Measurements	3
EME 521	Mathematical Modeling of Energy and Mineral Systems	3
EME 531	Thermodynamics of Energy and Mineral Systems	3

An additional set of prescribed twelve (12) option credits (as a minimum) must be taken if the student chooses to pursue an EME disciplinary option (petroleum and natural gas engineering, mining and mineral process engineering, fuel science, or energy systems engineering). Students are not required to choose an option and may complete the base program in EME.

Students pursuing an M.S. degree in EME will be required to complete a prescribed culminating research experience and the minimum amount of credits associated with each experience, which include the completion of minimum core and option (if any) course requirements. The thesis and non-thesis M.S. culminating experience tracks are:

THESIS-BASED M.S. in EME (30 credits total): Students are required to complete a minimum of 30 credits total (at least 18 at the 500 or 600 level) including: 24 credits in course work, 6 thesis credits (EME 600 Thesis Research), and a thesis accepted by the adviser(s) and committee members, the head of the graduate program, and the Graduate School. The student must pass a thesis defense.

NON-THESIS BASED M.S. in EME (36 credits total): Students are required to complete a minimum of 36 credits in total (at least 24 at the 500 level) including: 33 credits in course work and 3 credits for the completion of a culminating research experience. Within the 33 credits of coursework, M.S. students must take at least two extra courses (6 credits) from the EME core course list (beyond the six credit M.S. core requirement) or chosen graduate option (beyond the option’s 12-credit minimum option requirement). The non-thesis culminating research experiences are:

- **Paper-based M.S.:** Students take three (3) credits of non-thesis research (EME 596 Individual Studies) and complete a satisfactory scholarly paper evaluated by adviser(s) and a reader.
- **Course-based M.S.:** Students take a capstone research course (EME 580 Methodology of Research in EME (3 cr.) where they will create a work product demonstrating evidence of analytical thinking and synthesis of knowledge in the Energy and Mineral Engineering field.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The Ph.D. program in Energy and Mineral Engineering emphasizes scholarly research and helps students prepare for research and related careers in industry, government and academe. The Ph.D. program in Energy and Mineral Engineering requires completing a minimum of twelve (12) post-M.S. course credits, which must include the completion of all minimum core and option (if any) course requirements, and twelve (12) research credits. For students without an M.S. degree, 24 additional course credits must be taken to complete a total of 36 course credits and 48 credits total overall. At least 18 credits of these must be at the 500 or 600 level. A student’s Ph.D. committee can require additional course work based on the student’s background and research plans.

Ph.D. students must take at least one (1) course (3 credits of core courses) from the following list of prescribed (core) courses. Ph.D. students without an M.S. are required to take three (3) courses (9 credits of core courses) from this list:

Code	Title	Credits
EME 501	Design Under Uncertainty in Energy and Mineral Systems	3
EME 511	Interfacial Physical-Chemical Systems, Processes, and Measurements	3
EME 521	Mathematical Modeling of Energy and Mineral Systems	3
EME 531	Thermodynamics of Energy and Mineral Systems	3
EME 551	Safety, Health and Environmental Risks in Energy and Mineral Production	3

An additional set of prescribed twelve (12) option credits (as a minimum) must be taken if the student chooses to pursue an EME disciplinary option (petroleum and natural gas engineering, mining and mineral process engineering, fuel science, or energy systems engineering). Students are not required to choose an option and may complete the base program in EME.

Acceptance into the Ph.D. degree program in Energy and Mineral Engineering is based on the student's performance on the Ph.D. qualifying examination administered by the Graduate Faculty of the EME graduate program. The Ph.D. Qualifying Examination in EME will measure the student's fundamental knowledge of subjects covered in the program and interest area(s) of the individual candidate. It is intended to determine whether a student has the preparation, intellectual capacity, and professional attitude to complete a Ph.D. program successfully.

A Ph.D. comprehensive examination is required of all Ph.D. candidates and should be taken after substantial completion of all Ph.D. course work requirements. To earn the Ph.D. degree, doctoral students must also write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School. In addition, the student must pass a final oral examination (the dissertation defense).

Options

EME students are not required to choose a graduate option and may complete the base program in EME. However, M.S. and Ph.D. students of the EME graduate program who desire disciplinary identity may choose from among the following available graduate options:

- Energy systems engineering (ESysE)
- Fuel science (FSc)
- Mining and mineral process engineering (MMPE)
- Petroleum and natural gas engineering (PNGE)

The mandatory minimum course requirement for each of these options is 12 credits (4 courses) selected from the list of option-specific courses provided below. Student may apply the option to either the M.S. or Ph.D. degrees, or both, provided that new and appropriate substitute courses are taken as approved by the EME graduate program officer.

Energy Systems Engineering Option

Code	Title	Credits
Required Courses		
Select 12 credits from the following:		12
EME 522	Computational Methods for Electric Power Systems Analysis	
EME 523	Stochastic Optimization Methods of Energy and Environmental Systems	
EME 524	Machine Learning for Energy and Mineral Engineering Problems	

EME 526	Solar Utility and Portfolio Management	
EME 527	Stochastic Modeling of Spatial Variability in Energy and Environmental Systems	
ENNEC 540	Economic Analysis of Energy Markets	
IE 505	Linear Programming	
IE 516	Applied Stochastic Processes	
Total Credits		12

Fuel Science Option

Code	Title	Credits
Required Courses		
Select 12 credits from the following:		12
CHE 544	General Transport Phenomena	
or CHE 546	Transport Phenomena II	
EME/MATSE 570	Catalytic Materials	
or CHE 536	Heterogeneous Catalysis	
FSC 503	Analytical Methods in Fuel Science	
or CHE 510	Surface Characterization of Materials	
FSC 504	Problems in Fuels Engineering	
FSC 506	Carbon Reactions	
ME 523	Numerical Solutions Applied to Heat Transfer and Fluid Mechanics Problems	
Total Credits		12

Mining and Mineral Process Engineering Option

Code	Title	Credits
Required Courses		
Select 12 credits from the following:		12
MNG 512	Valuation of Mineral Properties and Mining Projects	
MNG 541	Surface Mine Equipment Selection Analysis	
MNG 554	Rock Mechanics Design	
MNPR 505	Particle Separation	
MNPR 507	Hydrometallurgical Processing	
Total Credits		12

Petroleum and Natural Gas Engineering Option

Code	Title	Credits
Required Courses		
Select 12 credits from the following: ¹		12
PNG 501	Flow in Porous Media	
PNG 502	Coupled Flow and Deformation in Porous Media	
PNG 512	Numerical Reservoir Simulation	
PNG 518	Design of Miscible Recovery Projects	
PNG 520	Thermodynamics of Hydrocarbon Fluids	
PNG 526	Well Stimulation	
PNG 530	Natural Gas Engineering	
PNG 555	Unconventional Resources Analysis	
PNG 566	Reservoir Characterization	
PNG 577	Production and Completions Engineering	

PNG 597 Special Topics (when taught, may be used to partially satisfy the PNGE option minimum credit requirement)

Total Credits **12**

¹ PNG 596 Individual Studies credits may not be used within this option course credit count.

Dual-Titles

Dual-title M.S. and Ph.D. in TRANSDISCIPLINARY RESEARCH ON ENVIRONMENT AND SOCIETY

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirement

Students must apply and be admitted to the graduate program in EME and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the TREES dual-title program. Refer to the Admission Requirements section of the Transdisciplinary Research on Environment and Society Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/transdisciplinary-research-environment-society/>). Doctoral students should enroll in a dual-title graduate degree program early in their training, and no later than the end of the fourth semester (not counting summer semesters) of entry into the graduate major program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in EME, listed above. In addition, students must complete the degree requirements for the dual title in TREES, listed on the TREES Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/transdisciplinary-research-environment-society/>).

The qualifying examination for Energy & Mineral Engineering will satisfy the qualifying exam requirement for the dual-title degree program in TREES. In addition to the general Graduate Council requirements for Ph.D. committees, the Ph.D. committee of an EME and TREES dual-title Ph.D. student must include at least one member of the TREES Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in TREES, the member of the committee representing TREES must be appointed as co-chair. The TREES representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in EME and TREES. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-title M.S. and Ph.D. in Energy and Mineral Engineering and Operations Research

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Students must apply and be admitted to the graduate program in EME and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Operations Research dual-title program. Refer to the Admission Requirements section of the Operations Research Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>). Doctoral students must be admitted into the dual-title degree program in Operations Research prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in EME, listed above. In addition, students must complete the degree requirements for the dual-title in Operations Research, listed on the Operations Research Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from EME and must include at least one Graduate Faculty member from the Operations Research program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both EME and Operations Research. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of an EME and Operations Research dual-title Ph.D. student must include at least one member of the Operations Research Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Operations Research, the member of the committee representing Operations Research must be appointed as co-chair. The Operations Research representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in EME and Operations Research. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Integrated Undergrad-Grad Programs

The EME graduate program offers integrated B.S./M.S. programs designed to allow academically superior and research-focused

undergraduate students in five B.S. degree programs—Energy Business and Finance; Energy Engineering; Environmental Systems Engineering; Mining Engineering; and Petroleum and Natural Gas Engineering—also to obtain an M.S. degree in Energy and Mineral Engineering (EME) within five years of study.

Integrated B.S. in Energy Business and Finance and M.S. in Energy and Mineral Engineering

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Energy Business and Finance with the M.S. in Energy and Mineral Engineering offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- University Park

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students must apply to the program via the Graduate School application for admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet all the admission requirements of the Graduate School and the EME graduate program for the Master of Science degree. Undergraduate students with sixth semester standing and minimum grade-point average of 3.5 who wish to complete the Integrated B.S./M.S. program should apply to the Graduate School and the EME IUG program before the end of their junior year. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.

Three faculty letters of recommendation are required. A statement of purpose and a plan of study covering the five year period, prepared in consultation with an adviser, and approved by the program officers of the B.S. major and the EME graduate program must accompany the application. The plan should be presented to the undergraduate and graduate program officers prior to being admitted into the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program. Graduate Record Examination (GRE) scores may be submitted by IUG applicants but are not required. The application will be reviewed by the Admissions Committee of the EME Graduate program and acted upon by the EME Graduate Program Officer.

Degree Requirements

Students must fulfill all degree requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Science degrees are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). Degree requirements for the Master of Science in EME are listed in the Master of Science Degree Requirements section above. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.S. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

The courses that will double count are: six (6) credits of the two 500-level EME core courses taken to satisfy M.S. core requirement and an additional six (6) credits of 400-level courses taken to satisfy 7th and 8th semester core courses from the undergraduate degree:

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
EBF 401	Strategic Corporate Finance for the Earth, Energy, and Materials Industries	3
EBF 473	Risk Management in Energy Industries	3
EME 501	Design Under Uncertainty in Energy and Mineral Systems	3
EME 511	Interfacial Physical-Chemical Systems, Processes, and Measurements	3
EME 521	Mathematical Modeling of Energy and Mineral Systems	3
EME 531	Thermodynamics of Energy and Mineral Systems	3
EME 551	Safety, Health and Environmental Risks in Energy and Mineral Production	3

Integrated B.S. in Energy Engineering and M.S. in Energy and Mineral Engineering

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Energy Engineering with the M.S. in Energy and Mineral Engineering offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- University Park

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs

(<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students must apply to the program via the Graduate School application for admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet all the admission requirements of the Graduate School and the EME graduate program for the Master of Science degree. Undergraduate students with sixth semester standing and minimum grade-point average of 3.5 who wish to complete the Integrated B.S./M.S. program should apply to the Graduate School and the EME IUG program before the end of their junior year. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.

Three faculty letters of recommendation are required. A statement of purpose and a plan of study covering the five year period, prepared in consultation with an adviser, and approved by the program officers of the B.S. major and the EME graduate program must accompany the application. The plan should be presented to the undergraduate and graduate program officers prior to being admitted into the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program. Graduate Record Examination (GRE) scores may be submitted by IUG applicants but are not required. The application will be reviewed by the Admissions Committee of the EME Graduate program and acted upon by the EME Graduate Program Officer.

Degree Requirements

Students must fulfill all degree requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Science degrees are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). Degree requirements for the Master of Science in EME are listed in the Master of Science Degree Requirements section above. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.S. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent

study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

The courses that will double count are: six (6) credits of the two 500-level EME core courses taken to satisfy M.S. core requirement and an additional six (6) credits of 400-level courses taken to satisfy 7th and 8th semester core courses from the undergraduate degree:

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
EGEE 441	Electrochemical Engineering Fundamentals	3
EGEE 451	Energy Conversion Processes	3
EGEE 464W	Energy Design Project	3
EME 460	Geo-resource Evaluation and Investment Analysis	3
EME 501	Design Under Uncertainty in Energy and Mineral Systems	3
EME 511	Interfacial Physical-Chemical Systems, Processes, and Measurements	3
EME 521	Mathematical Modeling of Energy and Mineral Systems	3
EME 531	Thermodynamics of Energy and Mineral Systems	3
EME 551	Safety, Health and Environmental Risks in Energy and Mineral Production	3
FSC 432	Petroleum Processing	3

Integrated B.S. in Environmental Systems Engineering and M.S. in Energy and Mineral Engineering

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Environmental Systems Engineering with the M.S. in Energy and Mineral Engineering offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- University Park

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students must apply to the program via the Graduate School application for admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet all the admission requirements of the Graduate School and the EME graduate program for the Master of Science degree. Undergraduate students with sixth semester standing and minimum grade-point average of 3.5 who wish to complete the Integrated B.S./M.S. program should apply to the Graduate School and the EME IUG program before the end of their junior year. Before applying to the Graduate

School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.

Three faculty letters of recommendation are required. A statement of purpose and a plan of study covering the five year period, prepared in consultation with an adviser, and approved by the program officers of the B.S. major and the EME graduate program must accompany the application. The plan should be presented to the undergraduate and graduate program officers prior to being admitted into the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program. Graduate Record Examination (GRE) scores may be submitted by IUG applicants but are not required. The application will be reviewed by the Admissions Committee of the EME Graduate program and acted upon by the EME Graduate Program Officer.

Degree Requirements

Students must fulfill all degree requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Science degrees are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). Degree requirements for the Master of Science in EME are listed in the Master of Science Degree Requirements section above. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.S. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

The courses that will double count are: six (6) credits of the two 500-level EME core courses taken to satisfy M.S. core requirement and an additional six (6) credits of 400-level courses taken to satisfy 7th and 8th semester core courses from the undergraduate degree:

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
EME 501	Design Under Uncertainty in Energy and Mineral Systems	3
EME 511	Interfacial Physical-Chemical Systems, Processes, and Measurements	3
EME 521	Mathematical Modeling of Energy and Mineral Systems	3
EME 531	Thermodynamics of Energy and Mineral Systems	3
EME 551	Safety, Health and Environmental Risks in Energy and Mineral Production	3

ENVSE 404W	Surface and Interfacial Phenomena in Environmental Systems	3
ENVSE 427	Pollution Control in the Process Industries	3
ENVSE 450	Environmental Health and Safety	3
ENVSE 457	Industrial Hygiene Measurements	3
ENVSE 470	Engineering Risk Analysis	3
ENVSE 480	Environmental Systems Engineering Process Design	3

Integrated B.S. in Mining Engineering and M.S. in Energy and Mineral Engineering

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Mining Engineering with the M.S. in Energy and Mineral Engineering offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- University Park

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students must apply to the program via the Graduate School application for admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet all the admission requirements of the Graduate School and the EME graduate program for the Master of Science degree. Undergraduate students with sixth semester standing and minimum grade-point average of 3.5 who wish to complete the Integrated B.S./M.S. program should apply to the Graduate School and the EME IUG program before the end of their junior year. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.

Three faculty letters of recommendation are required. A statement of purpose and a plan of study covering the five year period, prepared in consultation with an adviser, and approved by the program officers of the B.S. major and the EME graduate program must accompany the application. The plan should be presented to the undergraduate and graduate program officers prior to being admitted into the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program. Graduate Record Examination (GRE) scores may be submitted by IUG applicants but are not required. The application will

be reviewed by the Admissions Committee of the EME Graduate program and acted upon by the EME Graduate Program Officer.

Degree Requirements

Students must fulfill all degree requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Science degrees are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). Degree requirements for the Master of Science in EME are listed in the Master of Science Degree Requirements section above. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.S. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

The courses that will double count are: six (6) credits of the two 500-level EME core courses taken to satisfy M.S. core requirement and an additional six (6) credits of 400-level courses taken to satisfy 7th and 8th semester core courses from the undergraduate degree:

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
EME 501	Design Under Uncertainty in Energy and Mineral Systems	3
EME 511	Interfacial Physical-Chemical Systems, Processes, and Measurements	3
EME 521	Mathematical Modeling of Energy and Mineral Systems	3
EME 531	Thermodynamics of Energy and Mineral Systems	3
EME 551	Safety, Health and Environmental Risks in Energy and Mineral Production	3
GEOSC 470W	Introduction to Field Geology	3
MNG 410	Underground Mining	3
MNG 441	Surface Mining Systems and Design	3
MNG 451W	Mining Engineering Project	1-5

Integrated B.S. in Petroleum and Natural Gas Engineering and M.S. in Energy and Mineral Engineering

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Petroleum and Natural Gas Engineering with the M.S. in Energy and Mineral Engineering offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- University Park

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students must apply to the program via the Graduate School application for admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet all the admission requirements of the Graduate School and the EME graduate program for the Master of Science degree. Undergraduate students with sixth semester standing and minimum grade-point average of 3.5 who wish to complete the Integrated B.S./M.S. program should apply to the Graduate School and the EME IUG program before the end of their junior year. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.

Three faculty letters of recommendation are required. A statement of purpose and a plan of study covering the five year period, prepared in consultation with an adviser, and approved by the program officers of the B.S. major and the EME graduate program must accompany the application. The plan should be presented to the undergraduate and graduate program officers prior to being admitted into the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program. Graduate Record Examination (GRE) scores may be submitted by IUG applicants but are not required. The application will be reviewed by the Admissions Committee of the EME Graduate program and acted upon by the EME Graduate Program Officer.

Degree Requirements

Students must fulfill all degree requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Science degrees are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). Degree requirements for the Master of Science in EME are listed in the Master of Science Degree Requirements section above. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.S. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

The courses that will double count are: six (6) credits of the two 500-level EME core courses taken to satisfy M.S. core requirement and an additional six (6) credits of 400-level courses taken to satisfy 7th and 8th semester core courses from the undergraduate degree:

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
EME 501	Design Under Uncertainty in Energy and Mineral Systems	3
EME 511	Interfacial Physical-Chemical Systems, Processes, and Measurements	3
EME 521	Mathematical Modeling of Energy and Mineral Systems	3
EME 531	Thermodynamics of Energy and Mineral Systems	3
EME 551	Safety, Health and Environmental Risks in Energy and Mineral Production	3
PNG 420	Applied Reservoir Analysis and Secondary Recovery	3
PNG 425	Principles of Well Testing and Evaluation	3
PNG 430	Reservoir Modeling	3
PNG 440W	Formation Evaluation	3
PNG 480	Surface Production Engineering	3

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/>)

gsad/gsad-900/gsad-901-graduate-assistants/) set by The Graduate School.

Graduate students are supported by a variety of government and industry fellowships, and research and teaching assistantships. Stipends vary depending on the source.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Energy and Mineral Engineering (EME) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/eme/>)

Fuel Science (FSC) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/fsc/>)

Petroleum and Natural Gas Engineering (PNG) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/png/>)

Learning Outcomes

Master of Science (M.S.)

1. KNOW: Graduates will be able to demonstrate deep understanding and proficiency in project evaluation methods, optimization and application of mechanistic, thermodynamic, fluid flow, and kinetic analysis methods for integrative design of energy and mineral engineering systems.
2. CREATE: Graduates will demonstrate proficiency in designing and executing a research plan to address real-world problems in the field of energy and mineral engineering and economics.
3. CRITICAL THINKING: Graduates will be able to review and critically analyze work by others in the broad area of energy and mineral engineering and economics.
4. COMMUNICATE: Graduates will be able to effectively communicate their research findings to scholars in the field and broad audiences through formal presentations and written works.
5. PROFESSIONAL PRACTICE: Graduates will demonstrate a commitment to conduct themselves in accordance with the highest ethical standards and active engagement in service to the profession and society.

Doctor of Philosophy (Ph.D.)

1. KNOW: Graduates will demonstrate in-depth knowledge of the core theories and methods in the field of energy and mineral engineering as well as within one of the program options. This will include the application of physics, chemistry, advanced mathematics, economics and/or engineering principles to problems in energy and mineral engineering.
2. CREATE: Graduates will be able to creatively synthesize new ideas or hypotheses in energy and mineral engineering and economics, devise critical tests of hypotheses, and/or develop unique solutions to problems in energy and mineral engineering and economics.
3. APPLY: Graduates will be able to carry out independent and original research studies that address current problems in energy and mineral engineering synthesizing theory and/or experiments.

4. **CRITICAL THINKING:** Graduates will be able to review and critically analyze work by others in their field of specialty.
5. **COMMUNICATE:** Graduates will be able to convey ideas or arguments in clear, concise, well-organized proposals, papers and reports as well as in formal, oral presentations.
6. **PROFESSIONAL PRACTICE:** Graduates will demonstrate the ability to collaborate in a collegial and ethical manner with other professionals within their field and within diverse scientific backgrounds.

Contact

Campus	University Park
Graduate Program Head	Jeremy Michael Gernand
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Jeremy Michael Gernand
Program Contact	Lan Ziegler 103 Hosler Building University Park PA 16802 llz5043@psu.edu (814) 865-6511
Program Website	View (https://www.eme.psu.edu/)

Energy, Environmental, and Food Economics

Graduate Program Head	Katherine Zipp
Program Code	EEFE
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Dual-Title Ph.D. and M.S. in Energy, Environmental, and Food Economics and Demography Dual-Title Ph.D. and M.S. in Energy, Environmental, and Food Economics and Operations Research
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=EEFE)

The programs in Energy, Environmental, and Food Economics (EEFE) are designed to educate students as applied research economists in the fields of energy economics, environment and natural resource economics, and industrial organization in the food sector. The EEFE graduate program offers Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) degrees. Through completion of advanced course work and rigorous skills training, the Ph.D. and M.S. programs will prepare students to conduct independent research in accordance with the highest ethical standards, scientific integrity, and interpersonal collegiality, and to effectively interpret and communicate the results of their research. The M.S. degree is a research-oriented degree. Thus, a strong component of the M.S. candidate's program includes training in scientific methods as well as techniques of analysis applicable to the field. Additional depth and breadth of training required in the EEFE Ph.D. curriculum will prepare students to conduct original research that advances scientific knowledge in their fields of specialization. Students will also acquire the background and skills necessary to be effective teachers, mentors, and practitioners of economics. As an intercollege graduate program, EEFE faculty members reside in several Penn State departments and

Colleges. Students in the program have access to and utilize resources of the participating departments (courses, faculties and facilities).

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Scores from the Graduate Record Examinations (GRE), or from a comparable substitute examination accepted by the graduate program, are required for admission. At the discretion of a graduate program, a student may be admitted provisionally (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/provisional-admission/>) for graduate study in a program without these scores. Letters of recommendation and an applicant's statement of purpose are also required.

Students admitted to the M.S. program are expected to have:

- At least 9 credits in economics, including intermediate undergraduate microeconomic theory and intermediate undergraduate macroeconomic theory.
- Introductory statistics and two semesters of calculus.
- A minimum 3.00 junior/senior GPA (on a 4.00 scale).

Promising students with special backgrounds, abilities, and interests who do not meet these requirements may be admitted provisionally (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/provisional-admission/>) at the discretion of the program. Students provisionally admitted (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/provisional-admission/>) to the program are required to acquire the necessary background skills in economics, mathematics and statistics once they join the program.

Students admitted to the Ph.D. program are in general expected, though not required, to have a master's degree in economics, agricultural economics, resource economics or other closely related field. Consistent with this general expectation, students admitted to the Ph.D. program should have course work in:

- Differential and integral calculus, and linear algebra.
- Master's-level economic theory.
- Master's-level statistics/econometrics.

Students admitted to the Ph.D. program are also expected to have a minimum 3.00 Grade Point Average (GPA) in master's-level course work (on a 4.00 scale). Exceptions to the minimum 3.00 GPA may be made for students with special backgrounds, abilities, and interests at the discretion of the program. Promising students who seek to enter the Ph.D. program but who have course work deficiencies may be admitted to the M.S. program and subsequently apply to the Ph.D. program after successfully eliminating the deficiencies. Completion of the M.S. degree is not required of students admitted to the Ph.D. program from the M.S. program. The expected time to completion of the Ph.D. for students without course work deficiencies is 3.5 to 4 years.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A minimum of 30 credits at the 500 and 600 level is required for the EEFE M.S. degree, including 6 credits of research (EEFE 600 or EEFE 610). Courses taken to remove deficiencies in preparation may extend the minimum number of credits required. A minor is not required. EEFE M.S. students are required to write a thesis and to pass a final oral examination as part of the requirements for the degree. The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School.

Code	Title	Credits
Required Courses		
EEFE 510	Econometrics I	3
EEFE 511	Econometrics II	3
EEFE 512	Applied Microeconomic Theory I	3
EEFE 527	Quantitative Methods I	3
EEFE 529	Foundations of Economic Welfare Analysis	3
Electives		
9 credits of field electives taught at the 500 level. These courses will be chosen in consultation with the student's academic adviser and cannot include readings or independent study courses (596s).		9
Culminating Experience		
EEFE 600 or EEFE 610	Thesis research	6
Total Credits		30

M.S. degree students must complete Scholarship and Research Integrity (SARI) Training (10 hours).

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Students in the EEFE Ph.D. program will be required to complete 36 credits of course work at the 500- and 600-level, write and successfully defend a second year paper, write and successfully defend a Ph.D. dissertation, and pass a qualifying examination and a comprehensive examination. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Course work requirements include 21 credits of core course work, at least 12 credits of field courses, and 3 credits of elective courses selected from a list of approved electives maintained by the program office.

Code	Title	Credits
Required Courses		
ECON 502	Microeconomic Analysis ¹	3
EEFE 510	Econometrics I	3
EEFE 511	Econometrics II	3
ECON 521	Advanced Microeconomic Theory	3
EEFE 527	Quantitative Methods I	3
AEREC 533	Rural Development Research Methods and Topics	3

EEFE 529	Foundations of Economic Welfare Analysis	3
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Ph.D. Field Course Requirements

Two fields consisting of a minimum of 6 credits each from designated courses.	12
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Energy Economics, Policy and Systems

ENNEC 540	Economic Analysis of Energy Markets	
ENNEC 560	Empirical Research in Energy Economics and Policy	

Environment and Natural Resource Economics

EEFE 519	Resource and Environmental Economics I	
EEFE 541	Resource and Environmental Economics II	

Food Industrial Organization

AEREC 503	Agricultural Marketing	
EEFE 536	Economics of Food Behavior and Health	

Electives

A minimum of 3 credits at the 500 level, of which 3 credits must be selected from the following list:

EEFE 531	Applied Microeconometrics I	3
or ENNEC 541		

Total Credits		36
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- 1 Students selecting the Energy Systems Field may petition to substitute EME 501 for ECON 502.

Ph.D. degree students must also complete Scholarship and Research Integrity (SARI) Training (10 hours).

Dual-Titles

Dual-Title M.S. and Ph.D. in Energy, Environmental, and Food Economics and Demography

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admissions Requirements

Students must apply and be admitted to the graduate program in EEFE and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Demography dual-title program. Refer to the Admission Requirements section of the Demography Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/demography/>). Doctoral students must apply for enrollment into the dual-title degree program in Demography prior to taking the qualifying examination in EEFE.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in EEFE. In addition, students pursuing the dual-title Ph.D. in EEFE and Demography must complete the degree requirements for the dual-title in Demography, listed on the Demography Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/demography/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from EEFE and must include at least one Graduate Faculty member from the Demography program.

Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both EEFE and Demography. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of an EEFE and Demography dual-title doctoral degree student must include at least one member of Demography Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Demography, the member of the committee representing Demography must be appointed as co-chair. The Demography representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students enrolled in the dual-title program are required to write and orally defend a dissertation on a topic that reflects their original research and education in EEFE and Demography. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title M.S. and Ph.D. in Energy, Environmental, and Food Economics and Operations Research

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admissions Requirements

Students must apply and be admitted to the graduate program in EEFE and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Operations Research dual-title program. Refer to the Admission Requirements section of the Operations Research Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>). Doctoral students must apply for enrollment into the dual-title degree program in Operations Research prior to taking the qualifying examination in EEFE.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in EEFE. In addition, students pursuing the dual-title Ph.D. in EEFE and Operations Research must complete the degree requirements for the dual-title in Operations Research, listed on the Operations Research Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from EEFE and must include at least one Graduate Faculty member from the Operations Research program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both EEFE and Operations Research. Dual-title graduate degree students may require an additional semester to

fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of an EEFE and Operations Research dual-title doctoral degree student must include at least one member of Operations Research Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Operations Research, the member of the committee representing Operations Research must be appointed as co-chair. The Operations Research representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students enrolled in the dual-title program are required to write and orally defend a dissertation on a topic that reflects their original research and education in EEFE and Operations Research. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by

graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Agricultural Economics and Rural Sociology (AEREC) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/aerec/>)

Energy, Environmental, and Food Economics (EEFE) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/eefe/>)

Contact

Campus	University Park
Graduate Program Head	Katherine Yoder Zipp
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Douglas Wrenn
Program Contact	Kayla Sgobba 201 Armsby Bldg University Park PA 16802 kam6227@psu.edu (814) 867-0285
Program Website	View (http://aese.psu.edu/graduateprograms/eefe/)

Engineering

Graduate Program Head	Sven Bilén
Program Code	ENGR
Campus(es)	World Campus
Degrees Conferred	Doctor of Engineering (D.Eng.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=ENGR)

The Doctor of Engineering degree program in Engineering is a fully online program designed to meet the needs of working professionals who are interested in continuing their graduate studies with an applied research focus, enabling them to tackle research areas that are relevant to their industry's needs. The core D.Eng. objectives include enhancing technical engineering knowledge; developing research skills and applying research methods to an identified need within industry; and developing professional leadership competencies. To support these objectives, professional core coursework will include leadership theory and practice, product innovation and innovation management, project management, and engineering across cultures and nations. Students will select 15 technical elective credits in subject areas that support their research interests and in consultation with their advisor and committee. These technical electives will increase the student's engineering expertise and will form the foundation for their research pursuits. The program culminates with a praxis research project focused on applied research executed in an industry environment. Students will identify an industry problem and use applied research methods to develop a proposed solution and evaluation of the solution in meeting industry needs.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to

Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

To maintain a high-quality program, it is important that our students are also of a caliber to succeed. As such, the admission requirements for the students enrolling in the online program are similar to those of our resident Ph.D. students. Online students will only be accepted into the program with approval from the D.Eng. Admissions Committee. Within SEDI, the Admissions Committee (made up of COE Graduate Faculty) will provide recommendations to the Director of Graduate Studies on accepting students to the D.Eng. ENGR degree program. Admission decisions will also be based upon relevant work experience and recommendation letters. The following are additional specific requirements:

- It is expected that students have a Master of Science or Master of Engineering degree in a suitable engineering (or related technical) field from a U.S. regionally accredited institution or from an officially recognized degree-granting international institution.
- Grade-point average (4.0 scale) in master's program: Cumulative graduate GPA ≥ 3.0
- Three letters of reference (The letters should be solicited from professional colleagues and faculty who can attest to the applicant's ability). At least one reference should be from your employer indicating they support the praxis topic and specifying what resources you will have access to in support of the topic, e.g., allocated time, lab support, data. This reference letter would ideally come from the immediate or area supervisor of the applicant.
- A statement of purpose/goal statement that includes an overview of an identified problem to be examined as part of the required praxis research.
- A published or unpublished scientific paper, praxis, or other scholarly writing sample.
- A curriculum vitae or résumé.
- An interview (either in person or via internet-based video conferencing).

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

A minimum of 45 credits at the 400, 500, or 800 level is required, with a minimum of 24 at the 500 or 800 level.

The D.Eng. program emphasizes scholarly applied research and helps students prepare for research and related careers in industry, government, and academe. Students must pass written and/or oral qualifying examinations. The D.Eng. program is quite flexible, with 15 prescribed course credits (9 credits from ENGR 501, ENGR 804, ENGR 405, and ENGR 802; 3 credits from ENGR 820; 3 credits from STAT 500, STAT 501, STAT 505, or STAT 510, or approved numerical methods/analysis course) and 15 technical elective course credits allowing the student to customize their program of study to meet their research interests.

Students must also complete 15 research praxis credits (ENGR 810). The D.Eng. is awarded upon completion of a program of advanced study that includes the passing of comprehensive and final oral examinations as determined by the student's praxis committee, and a satisfactory praxis. A D.Eng. student must have 30 credits above a master's degree (i.e., 15 prescribed course credits and 15 technical elective course credits) before taking the comprehensive examination.

The D.Eng. program has a residency requirement that can be met by attending a 5 days on-campus residency or attending multiple shorter on-campus residencies that combined add to a minimum of 5 days. The D.Eng. program is a highly individualized program that takes into account the flexibility needs of its primarily non-traditional students and the unique relationship that student will have with their praxis advisor and committee. Hence, the residency requirement can be met in a number of methods, as long as the cumulative time on campus is at least 5 days. Tracking of residency days will be handled by the Graduate Program Support Assistant (GPSA) for the D.Eng. Program and communicated to the student. The D.Eng. Program will hold, on an annual basis (immediately prior to Fall semester), a 2-day D.Eng. orientation at University Park that will be offered to all students, but not required. It is expected that the remainder of the residency days will be obtained via other methods, e.g., visits to campus for research meetings with praxis faculty, students, and researchers; attendance in lab group meetings on campus; visits to attend on-campus workshops; and organized D.Eng. program-specific professional development activities that will be offered at least once per semester for those in the program and to the broader community. Working with the GPSA, it is the student's responsibility to ensure progress toward completed residency days. This requirement must be satisfied prior to the semester in which the final oral examination is administered. The GPSA will also track successful accomplishment of other program milestones in order to certify completion of all D.Eng. degree requirements.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://>

www.worldcampus.psu.edu/tuition-and-financial-aid/) of the World Campus website for more information.

As a professional online degree program, tailored to the working professional, traditional graduate research or teaching assistantships are not available. It is expected that students in this program will be supported by their employer or self-paid. However, graduate students may be supported by a variety of government and industry fellowships, traineeships, and other research assistantships.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Contact

Campus	World Campus
Graduate Program Head	Sven G Bilen
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Joanna F. DeFranco
Program Contact	Mariah L Germello 307 Engineering Design and Innovation Building University Park PA 16802 mld5449@psu.edu (814) 865-2771
Program Website	View (https://worldcampus.psu.edu/DEng/)

Engineering at the Nano-scale

Graduate Program Head	Albert Eliot Segall
Program Code	NANO
Campus(es)	University Park (M.S.)
Degrees Conferred	Master of Science (M.S.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=NANO)

The Master of Science (M.S.) in Engineering at the Nano-scale is an intensive one-year, 30-credit program requiring completion of a scholarly paper. This interdisciplinary program is ideal for individuals with a bachelor's degree in science, engineering, mathematics, or related fields who wish to gain an expanded knowledge and hands-on practices of semiconductor processing, nanomanufacturing, and bionanotechnology that can be implemented in many engineering applications.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Graduates in engineering, physical sciences, and mathematics who present a 3.00 grade-point average will be considered for admission. GRE scores are not required for admission.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The non-thesis residence-based Master of Science (M.S.) degree in Engineering at the Nano-scale is a one-year program. Students are required to start the program in the fall semester and complete their degree requirements, including all required course work and three credits of research resulting in a scholarly paper, and graduate by the end of summer following the second semester. The plan of study is as follows:

- Fall semester: 12 credits of course work+ 1 credit of ESC 596
- Spring semester: 12 credits of course work + 1 credit of ESC 596
- Summer semester: 3 credits of course work + 1 credit of ESC 596

At least 30 graduate credits must be earned, of which 18 must be from 500-level lecture/laboratory courses approved by the department. No more than 9 credits may be earned from 400-level courses including the required core course ESC 412.

Code	Title	Credits
Required Courses		
ESC 412	Nanotechnology: Materials, Infrastructure, and Safety	3
ESC 520	Engineering at the Nano-scale	3
ESC 521	Pattern Transfer at the Nano-scale	3
ESC 522	Fabrication and Characterization for Top-down Nano-manufacturing	3
ESC 523	Fabrication and Characterization for Bottom-up Nano-manufacturing	3
Electives		12
Culminating Experience		
ESC 596	Individual Studies (3 semesters of 1 credit each)	3
Total Credits		30

As the culminating experience, students must write a scholarly paper incorporating at least one area represented in the course work, upon successful completion of which 3 total credits of ESC 596 will be earned. The scholarly paper must demonstrate the student's capability to integrate and apply concepts and techniques learned in the courses and thereby demonstrate the technical, environmental, ethical, and safety knowledge needed to practice engineering at the nano-scale. This scholarly paper should reflect the high quality of research required to meet the Engineering Science and Mechanics M.S. degree standards, as determined by the ESM Graduate Officer and the ESM Graduate Curriculum Committee. Students who need more time to complete the final paper may extend the submission due date after the third semester (summer). The degree will be granted after the paper has been reviewed and approved, and all degree requirements have been met. Students are not required to remain in residence while they complete the final paper.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Nanotechnology (NANO) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/nano/>)

Learning Outcomes

1. **KNOW:** Demonstrate a mastery of core principles of nanoscience and nanotechnology.
2. **APPLY/CREATE:** Apply methods of fabrication and characterization of nanomaterials and nanodevices.
3. **COMMUNICATE:** Effectively communicate technical knowledge and laboratory practices including: ideas, designs, data analysis, findings, or decision justification in written, graphical and oral presentation formats.
4. **THINK:** Critically and creatively conceptualize and evaluate engineering problem formulations, analyses, and solutions.
5. **TEAMWORK:** Collaborate in a collegial and ethical manner with other professionals within their field and with diverse, cultural, scientific, and technical backgrounds.

6. **PROFESSIONAL PRACTICE:** Demonstrate a knowledge and the ability to practice the professional standards of safety and professional behavior.

Contact

Campus	University Park
Graduate Program Head	Albert Eliot Segall
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Albert Eliot Segall
Program Contact	Tammy L Coval The Pennsylvania State University 212 Earth and Engineering Sciences Building University Park PA 16802 tlc21@psu.edu (814) 863-4586 View (http://www.esm.psu.edu/)
Program Website	

Engineering Design

Graduate Program Head	David Mazyck
Program Code	EDSGN
Campus(es)	University Park (M.S., M.Eng.)
Degrees Conferred	Master of Science (M.S.) Master of Engineering (M.Eng.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=EDSGN)

The Engineering Design (DESIGN) program prepares the innovators of the future. Students may specialize in Design Computing, Product Realization, Human-Centered Design, and Humanitarian Engineering Design. Design Computing applies advanced computing to supercharge designers' abilities to create personalized products and services. Product Realization focuses on designing adaptive, flexible, and innovative products that challenge traditional product design and manufacturing approaches in support of growing markets. Human-Centered Design focuses on starting with empathy and applying rigorous processes and tools to transform user needs into viable engineered solutions. Humanitarian Engineering Design focuses on developing scalable and sustainable solutions for products, processes, and services that have the potential to change lives for millions of people in resource-constrained communities around the world.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Applicants with at least a 3.00 junior/senior grade-point average (on a 4.00 scale) and appropriate course backgrounds may be considered for admission. Exceptions to the minimum 3.00 grade-point average may be made for students with special backgrounds, abilities, and interests.

All applicants must submit official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>); international applicants must submit official transcripts,

degree, and diploma certificates in both English and their native language. Photocopies will not be accepted. Applicants must also submit a statement of objectives, resume, and three letters of recommendation. GRE scores will not be accepted.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Applicants for fall admission who wish to be considered for financial aid should complete the application process prior to December 15 of the preceding year.

Degree Requirements

Master of Engineering (M.Eng.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The M.Eng. degree is a non-thesis professional master's degree that provides training for advanced professional practice. To receive the Master of Engineering degree in Engineering Design, a student must complete at least 32 credits beyond the baccalaureate degree, and a scholarly report based on an independent studies course (EDSGN 596), or a domestic (ENGR 595A) or international (ENGR 595I) internship experience, and an engineering design portfolio (EDSGN 585). A minimum of 18 credits must be in the 500 series.

A minimum of 32 graduate credits is required as follows:

Code	Title	Credits
Required Courses		
EDSGN 581	Engineering Design Studio I	3
EDSGN 582	Multi-disciplinary Studio	3
EDSGN 585	Engineering Design Portfolio	1
EDSGN 590	Colloquium	1
Focus Area Electives		
Students must select a minimum 12 credits of focus area electives from the following:		12
EDSGN 401	Engineering Systems Design	
EDSGN 479	Human Centered Product Design and Innovation	
EDSGN 547	Designing for Human Variability	
EDSGN 548	Interaction Design	
EDSGN 549	Design Decision Making	
EDSGN 558	Systems Design	
General Electives		
Students must select 9 credits of general electives from the following: ¹		9
IE 418	Human/Computer Interface Design	
IE 460	Service Systems Engineering	
IE 470	Manufacturing System Design and Analysis	
IE 520	Multiple Criteria Optimization	
IE 557	Human-in-the-Loop Simulation	
IE 563	Computer-Aided Design for Manufacturing	
IST 413	Usability Engineering	

IST 520	Foundations in Human-Centered Design	
IST 521	Human-Computer Interaction: The User and Technology	
ME 561	Structural Optimization Using Variational and Numerical Methods	
ME 565	Optimal Design of Mechanical and Structural Systems	
MANGT 510	Project Management	
SYSEN 550		
SYSEN 555	Invention and Creative Design	
Culminating Experience		
Students must select one of the following:		3
EDSGN 596	Individual Studies	
ENGR 595A	Engineering Internship	
ENGR 595I	International Engineering Internship	
Total Credits		32

¹ Or from a list of approved courses maintained by the program.

The M.Eng. in Engineering Design requires the completion of a scholarly paper and the Engineering Design Portfolio.

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The M.S. degree is an academic degree, which is strongly oriented toward research. To receive the Master of Science degree in Engineering Design, a student must complete at least 32 credits beyond the baccalaureate degree. At least 18 credits in the 500 and 600 series, combined, must be included in the program. A minimum of 12 credits in course work (400 and 500 series), as contrasted with research, must be completed in the major program. A thesis is required and at least 6 credits of thesis research (EDSGN 600/EDSGN 610) must be included in the program.

A minimum of 32 graduate credits is required as follows:

Code	Title	Credits
Required Courses		
EDSGN 581	Engineering Design Studio I	3
EDSGN 582	Multi-disciplinary Studio	3
EDSGN 585	Engineering Design Portfolio	1
EDSGN 590	Colloquium	1
Focus Area Electives		
Students must select a minimum 12 credits of focus area electives from the following:		12
EDSGN 401	Engineering Systems Design	
EDSGN 479	Human Centered Product Design and Innovation	
EDSGN 547	Designing for Human Variability	
EDSGN 548	Interaction Design	
EDSGN 549	Design Decision Making	
EDSGN 558	Systems Design	
General Electives		
Students must select 6 credits of general electives from the following: ¹		6
IE 418	Human/Computer Interface Design	

IE 460	Service Systems Engineering	
IE 470	Manufacturing System Design and Analysis	
IE 520	Multiple Criteria Optimization	
IE 557	Human-in-the-Loop Simulation	
IE 563	Computer-Aided Design for Manufacturing	
IST 413	Usability Engineering	
IST 520	Foundations in Human-Centered Design	
IST 521	Human-Computer Interaction: The User and Technology	
ME 561	Structural Optimization Using Variational and Numerical Methods	
ME 565	Optimal Design of Mechanical and Structural Systems	
MANGT 510	Project Management	
SYSEN 550		
SYSEN 555	Invention and Creative Design	
Culminating Experience		
EDSGN 600	Thesis Research	6
or EDSGN 610	Thesis Research Off Campus	
Total Credits		32

¹ Or from a list of approved courses maintained by the program.

The M.S. in Engineering Design requires the completion of an M.S. thesis and the Engineering Design Portfolio.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

International students must take AEOCPT and score between 250 and 300 in order to begin a teaching assistantship; students who require remediation may be assigned a teaching assistantship only after addressing the deficiencies identified by the test.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Engineering Design (EDSGN) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/edsgn/>)

Contact

Campus	University Park
Graduate Program Head	David William Mazyck
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Sarah C Ritter
Program Contact	<p>Mariah L Germello 307 Engineering Design and Innovation Building University Park PA 16802 mld5449@psu.edu (814) 865-2771</p> <p>View (https://www.sedtapp.psu.edu/design/graduate-program/)</p>
Program Website	View (https://www.sedtapp.psu.edu/design/graduate-program/)

Engineering Leadership and Innovation Management

Graduate Program Head	David Mazyck
Program Code	ELIM
Campus(es)	University Park (M.Eng.)
Degrees Conferred	Master of Engineering (M.Eng.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=ELIM)

The program is designed to develop the attributes required by today's successful engineering leaders. Specifically, these include increased technical competency, expanded professional skills, the ability to identify opportunities for improvement, and the acumen to work effectively in a globally connected engineering environment. Upon completion of the full one-year program, the successful student will have developed and demonstrated abilities enabling them to:

- Evaluate leadership and innovation management strategies for corporate innovation and identify opportunities for new products and businesses in alignment with an organization's strengths and weaknesses within an existing business structure.
- Demonstrate an understanding of cultural and international boundaries, effectively considering the implications of cultural and international business differences on project implementation.

- Employ design thinking and project management strategies to lead engineering teams in solving complex engineering problems.
- Apply project management methods including the implementation of techniques for planning, scheduling, budgeting, and controlling project performance.
- Demonstrate proficiency in oral and written communication appropriate to engineering leadership and innovation management.
- Develop self-awareness of personal leadership attributes and areas for growth in fostering cultures of innovation and creativity in engineering teams.
- Explain corporate financial documents and develop financial projections for new innovations.

These learning outcomes will be achieved through a combination of lectures by faculty, invited guest lecturers, reading of key literature, individual and team projects (including international virtual-team projects), and practical involvement in an engineering capstone design/market development project.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Educational Background

The student cohort should reflect today's international engineering environment, with selective admittance. The admission requirements include:

- Applicants must hold an undergraduate degree in engineering, science, or relevant discipline. Applicants must have a 3.0 minimum undergraduate GPA (or equivalent). Exceptions to the minimum 3.0 grade-point average may be made for students with special backgrounds, abilities, and interests at the discretion of the program. Applicants will be accepted up to the number of places available for new students.
- 1 year of professional experience in an engineering position (or equivalent). Students wishing to enter the program directly from an undergraduate degree can fulfill the 1 year requirement for engineering experience through summer internships, summer employment, or co-op experiences plus additional experience within professional societies. Justification for this experience should be included in the Personal Statement during the application process.

Core Application Packet

- Completed official online Graduate School application (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>) and payment of nonrefundable application fee. The graduate application includes the following:
 - Personal statement: The Personal Statement should include a 2-3 page essay demonstrating your written communication skills with the following information: a) statement of purpose (career and educational goals), b) narrative describing your leadership and innovation experiences through summer internships, summer employment, co-op experiences, community engagement, professional societies, etc. and c) narrative describing your professional experience in an engineering position (or equivalent) to meet the 1 year requirement.

- Vita or Résumé.
- Three letters of recommendation that attest to your readiness for graduate study and document the requisite minimum of one year of work experience. Letters must be submitted through the online application. Within the online application you will be asked to enter the names and email addresses of three individuals who will be providing your recommendation. Those individuals will receive a note via email asking them to complete a brief form that will serve as your recommendation. Please inform all recommenders they must submit the form in order for your application to be complete.
- Official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>).

GRE scores will not be accepted.

Applicants who are still completing their baccalaureate requirements at the time of application may be provisionally admitted to the Graduate School (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/provisional-admission/>) conditional on the awarding of the baccalaureate degree.

Degree Requirements

Master of Engineering (M.Eng.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Total required credits for the ELIM program is 30 credits.

Code	Title	Credits
Required Courses		
ENGR 405	Project Management for Professionals ¹	3
ENGR 408	Leadership Principles ¹	3
ENGR 411	Entrepreneurship Business Basics ¹	3
ENGR 501	Engineering Leadership for Corporate Innovation	3
ENGR 802	Engineering Across Cultures and Nations	3
ENGR 804	Engineering Product Innovation	3
Electives ²		
500-level elective		3
500- or 800-level elective		3
400-, 500-, or 800-level elective		3
Culminating Experience		
ENGR 805	ELIM Capstone Project ³	3
Total Credits		30

1 Students entering the program who have previously taken ENGR 405, ENGR 408 or ENGR 411 will be required to substitute alternate courses under the direction of the program director.

2 These electives (course options list available) will be chosen by the student, in consultation with their company (if they are associated with a sponsoring company) and the ELIM program director. Electives should be chosen to meet the needs and interests of the student and can be selected from across the university. The electives can utilize existing courses within the graduate curricula of the College of Engineering, as well as any courses that are open to students from across the university such as the Smeal College of Business, Psychology, or Organization Development and Change and Workforce

Education and Development within the College of Education, allowing the student to expand his/her knowledge in a technical, business or psychology focus area. Students may also pursue a graduate certificate or minor through the completion of these elective credits. A list of recommended courses and potential certificates/minors that may be of interest to our students is maintained by the program office.

- The Capstone course provides an opportunity to apply and integrate the knowledge and skills that were gained throughout the ELIM program with strategic management concepts. Capstone projects will target real world opportunities, problems, and challenges of an existing organization. Students who successfully complete this course will be able to:
 - identify and assess the impact of opportunities and threats in a company's external environment, including its industry and its set of competitors;
 - identify and assess a company's internal strengths and weaknesses, and match them with its opportunities and threats to suggest alternative strategies;
 - define the business-level strategies of a company;
 - define competitors, competitive rivalry, competitive behavior, and competitive dynamics;
 - and describe corporate-level strategy of the company as it relates to the capstone project.

Minor

Requirements listed here are in addition to requirements for minors in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Successful engineers and technical experts are expected to be well versed not only in technical skills but also in professional skills such as communication, ethics, entrepreneurial thinking, and professionalism. These areas of leadership and innovation set technical experts apart and prepare them to be future global business leaders. This graduate minor is highly relevant to numerous graduate degrees associated with engineering, business, technical, or science related programs. This graduate minor consists of four 3-credit courses (12 credits) for master's students and five 3-credit courses (15 credits) for doctoral students.

Admission Requirements

- Applicants must hold an undergraduate degree in engineering, science, or relevant discipline.
- Applicants must have a 3.0 minimum undergraduate GPA (or equivalent). Exceptions to the minimum 3.0 grade-point average may be made for students with special backgrounds, abilities, and interests, at the discretion of the program.
- Applicants must be accepted and/or currently enrolled in a graduate program at Penn State. Official requests to add a minor to a doctoral candidate's academic record must be submitted to Graduate Enrollment Services prior to establishment of the dissertation committee and prior to scheduling the comprehensive examination.
- Applicants to the Engineering Leadership and Innovation Management (ELIM) minor must submit a Request to Add Graduate Minor form (<http://gradschool.psu.edu/forms-and-documents/ges-owned-forms-and-documents/addgrminorpdf/>).

Minor Requirements

In accordance with Graduate Council policy, a representative from the Graduate Faculty in Engineering Leadership and Innovation Management must be appointed to the dissertation committee of each student enrolled in the doctoral minor in Engineering Leadership and Innovation Management (ELIM).

Master's Minor

The Engineering Leadership and Innovation Management (ELIM) minor (12-credits) is comprised of four courses:

Code	Title	Credits
ENGR 501	Engineering Leadership for Corporate Innovation	3
ENGR 802	Engineering Across Cultures and Nations	3
ENGR 804	Engineering Product Innovation	3
ENGR 405	Project Management for Professionals ¹	3
Total Credits		12

¹ Related courses may be substituted for ENGR 405. Petitions for substitution may be made to the ELIM program office.

Doctoral Minor

The Engineering Leadership and Innovation Management (ELIM) doctoral minor (15-credits) is comprised of five courses:

Code	Title	Credits
ENGR 501	Engineering Leadership for Corporate Innovation	3
ENGR 802	Engineering Across Cultures and Nations	3
ENGR 804	Engineering Product Innovation	3
ENGR 405	Project Management for Professionals ¹	3
500-level elective in a related field ²		3
Total Credits		15

¹ Related courses may be substituted for ENGR 405. Petitions for substitution may be made to the ELIM program office.

² For a doctoral minor a 500-level elective in a related field is required. Students must obtain approval for the elective course from their ELIM advisor in advance of registering.

Student Aid

Refer to the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students in this program are not eligible for graduate assistantships.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Engineering (ENGR) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/engr/>)

Contact

Campus	University Park
Graduate Program Head	David William Mazyck
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Dena Lang
Program Contact	Mariah L Germello 307 Engineering Design and Innovation Building University Park PA 16802 mld5449@psu.edu (814) 865-2771
Program Website	View (http://www.sedtapp.psu.edu/eld/graduate-degrees.aspx)

Engineering Management (Capital)

Graduate Program Head	Vahid Motevalli
Program Code	EM
Campus(es)	Harrisburg (M.E.M.)
Degrees Conferred	Master of Engineering Management (M.E.M.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=EM)

The Master of Engineering Management degree program is a graduate professional degree program that integrates engineering with business and management principles. The program provides engineers with business and management perspectives and enhances their capabilities in the management of major projects, business initiatives, policies, and other activities in both the public and private sectors. Furthermore, it highlights the importance of technology strategy and intellectual properties management, and offers an environment for personal and professional networking that could hold significant future dividend.

The program is offered at Penn State Harrisburg as a partnership between the School of Science, Engineering, and Technology and the School of Business Administration, which is accredited at the undergraduate and graduate levels by AACSB International—the Association to Advance Collegiate Schools of Business International.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Applicants must have undergraduate degrees in engineering or technology from an accredited university and must have completed undergraduate course work in calculus and economics.

An undergraduate cumulative grade-point average of 3.0 or better on a 4.0 scale, and scores from the Graduate Management Admission Test (GMAT) or the Graduate Record Examination (GRE) are required for admission. Students demonstrating high potential but failing to meet the minimum GMAT or GRE score requirements may be considered on the basis of professional accomplishments and other criteria that may predict success in the program.

Applicants must submit the following:

- a complete Graduate School application for admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) with the nonrefundable application fee.
- official transcripts from all post-secondary institutions attended (<http://gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>).
- three (3) letters of reference, especially from faculty who can evaluate academic potential
- a personal statement of technical interest, goals, and experience
- test scores from the Graduate Management Admission Test (GMAT) or the Graduate Record Examination (GRE) [GRE scores are required for those indicating interest in an assistantship and to be eligible for many graduate fellowship opportunities.]

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of Engineering Management (M.E.M.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

All graduate students in Engineering Management are required to adhere to the requirements of Graduate Council, listed in the link above. These, however, are minimum requirements and the policies, procedures, and regulations listed below are additional and more specific for graduate students pursuing the Master of Engineering Management. Advisers will call pertinent regulations to the attention of their advisees, but it should be understood that it is the student's personal responsibility to see that all requirements listed are satisfied.

The Master of Engineering Management (M.E.M.) is a 33-credit graduate program that integrates engineering with business and management principles. The multidisciplinary, broadly based M.E.M. program provides engineers with business and management perspectives to enhance capabilities in management of large projects. Of the 33 credits required for the degree, 30 must be earned in 500-level graduate courses.

Code	Title	Credits
Required Courses		
ACCT 501	Financial Statement Analysis	3
EMCH 524A	Mathematical Methods in Engineering	3
ENGMT 511	Engineering for Energy and the Environment	3
FINAN 521	Corporate Finance	3
MNGMT 511	Organizational Behavior	3
MRKT 513	Marketing Management	3
SYSEN 505	Technical Project Management	3

Electives

The curriculum requires the completion of two free electives (6 credits) in any of the engineering disciplines. A list of these elective courses is maintained by the graduate program office.

Culminating Experience

All students are required to complete a culminating experience through a two-course capstone course sequence:

BUS 588	Strategic Management	3
MFGSE 550	Design for Manufacturability I	3

Total Credits **33**

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **KNOW.** Graduates will be able to demonstrate mastery of core principles in engineering management.
2. **PROBLEM SOLVING.**
 - a. Graduates will be able to apply business strategy to solve engineering management problems.
 - b. Graduates will be able to apply project management to solve engineering management problems.
3. **COMMUNICATE.** Graduates will be able to effectively communicate project outcomes, such as ideas, requirements, business analyses, findings, and justification for decisions.

- CRITICAL THINKING.** Graduates will be able to critically and creatively conceptualize, evaluate, and formulate engineering management problems, as well as perform the analyses required for problem definition.
- ETHICS AND PROFESSIONALISM.** Graduates will be able to demonstrate an understanding of professional and ethical responsibility and conduct themselves accordingly.

Contact

Campus	Harrisburg
Graduate Program Head	Vahid Motevalli
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Rafic A Bachnak
Program Contact	Kelly Batche W215 Olmsted - Penn State Harrisburg 777 West Harrisburg Pike Middletown PA 17057 klb68@psu.edu (717) 948-4349
Program Website	View (https://harrisburg.psu.edu/science-engineering-technology/engineering-science-management/master-professional-studies-engineering-management/)

Engineering Management (Great Valley)

Graduate Program Head	Raghu Sangwan
Program Code	ENGMT
Campus(es)	Great Valley (M.E.M.) World Campus (M.E.M.)
Degrees Conferred	Master of Engineering Management (M.E.M.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=ENGMT)

The Master of Engineering Management (MEM) is a 33-credit interdisciplinary graduate professional degree program that aims to prepare students the skills to manage complex, heterogeneous engineering projects, products, and services with the theoretical understanding to become leaders in technical organizations. The program offers experience in the analytical approaches to solving technical and sociotechnical problems, leading technical people and fostering effective teams, and managing technical projects in the presence of uncertainty and risk.

The program is offered at Penn State Great Valley and online through Penn State World Campus.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The Master of Engineering Management is developed for students with a background in engineering or science. Applicants with a four year undergraduate degree in engineering, mathematics, physics, computer science, or a related discipline will be considered. Applicants must have completed Calculus I equivalent to Penn State University's MATH 140. Test scores from the GMAT or GRE exams are not required, but will be considered by the admissions committee if submitted. Jr/Sr GPA of 3.0 or better on a 4.0 scale is required. Students must have three years or more work experience in an engineering or engineering-related position. Applicants must submit two letters of reference, and a one page personal statement of relevant experience and goals.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of Engineering Management

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

All students in the Master of Engineering Management program must complete a minimum of 33 credits at the 400, 500, or 800 level, with a minimum of 18 credits at the 500 or 800 level, and at least 6 credits at the 500 level. Students must maintain an average grade-point average of 3.0 or better in all course work. The program curriculum includes 18 credits of core courses, 12 credits of electives, and 3 credits of capstone experience.

Code	Title	Credits
Required Courses		
Prescribed courses for the degree include the following 18 credits of core courses:		
ENGMT 501	Engineering Management Science	3
ENGMT 510	Economics and Financial Studies for Engineers	3
SYSEN 505	Technical Project Management	3
SYSEN 536	Decision and Risk Analysis in Engineering	3
SYSEN 850	Creativity & Problem Solving I	3
ENGMT 841	Application of Statistics in Quality and Continuous Improvement	3
Electives		
An additional 12 credits of elective courses must be selected from the approved list of elective courses maintained by the graduate program office.		12
Culminating Experience		
ENGMT 539	Engineering Management Strategy	3
Total Credits		33

All students will complete their program of study with the 3-credit capstone course (ENGMT 539) that provides students with an opportunity to apply their knowledge of the engineering management theories, methods, processes, and tools, learned throughout their program, in a culminating and summative experience. The choice of project topic and exact form will be determined by the instructor. A written paper based on the applied project is required and must contain project description, analysis, and interpretation of its findings. Students

will be encouraged to upload their capstone work products to be available publicly via ScholarSphere: <https://scholarsphere.psu.edu/>. World Campus Engineering Management students will be encouraged to participate in the World Campus Graduate Capstone Exhibition.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Refer to the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students in this program are not eligible for graduate assistantships.

Financial aid for students in on-campus programs is in the form of student loans and a limited number of small scholarships, as described on the Penn State Great Valley website (<https://greatvalley.psu.edu/tuition-and-financial-aid/>).

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Engineering Management (ENGMT) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/engmt/>)

Learning Outcomes

1. **KNOW.** Demonstrate knowledge of foundational principles of engineering management including technical, social, and economic factors as applied to projects and personnel.
2. **CRITICAL THINKING.** Evaluate the financial aspects of projects and integrate them with different technical and engineering components.

3. **PROBLEM SOLVING.** Understand and estimate risk and its impact on the decision making process.
4. **COMMUNICATE.** Demonstrate the ability to communicate project findings effectively in written, spoken, and visual presentations to project stakeholders and a variety of professional audiences.
5. **TEAMWORK.** Demonstrate the ability to work with multi-disciplinary teams.

Contact

Campus	Great Valley
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Nil Hande Ergin
Program Contact	MICHELLE WHALEN Penn State Great Valley 30 East Swedesford Road Malvern PA 19355 mmw6441@psu.edu
Program Website	View (http://greatvalley.psu.edu/academics/masters-degrees/engineering-management/)
Campus	World Campus
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Nil Hande Ergin
Program Contact	MICHELLE WHALEN Penn State Great Valley 30 East Swedesford Road Malvern PA 19355 mmw6441@psu.edu
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/engineering-management-masters/overview/)

Engineering Science and Mechanics

Graduate Program Head	Albert Segall
Program Code	EMCH (M.Eng.); ESMCH (Ph.D., M.S.)
Campus(es)	University Park (Ph.D., M.S., M.Eng.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Master of Engineering (M.Eng.) in Engineering Mechanics Integrated B.S. in Engineering Science and M.S. in Engineering Science and Mechanics Joint M.D./Ph.D. with the College of Medicine
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=ESMCH)

Opportunities for graduate studies are available in interdisciplinary and multidisciplinary research areas including:

- Multiscale, multiphysical computational modeling and simulation
- Data Science AI, machine learning
- Brain Science, neural engineering, neuroethics
- Structural and health monitoring
- Advanced materials
 - elastodynamic metamaterials
 - electronic materials
 - twisted 2D materials
 - bioengineered materials
- Materials characterization
 - In-situ microscopy in extreme environments
 - Ultrasonic nondestructive evaluation
- Additive manufacturing
- Micro and nanomechanics
- Biomechanics and mechanobiology
- Quantum computation and information science
- Optoelectronics, nanophotonics, and lasers
- Dynamic systems, acoustics, and vibrations
- Emerging manufacturing process for materials, tissues, and devices
- Bionanoscience, biomedical electronics and devices
- Smart sensors
 - Flexible and stretchable biosensors
 - Label-free biosensors
 - Quantum sensors

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Applicants who hold a baccalaureate degree in engineering, the sciences, mathematics, engineering science, and materials who present at least a 3.00 grade-point average will be considered for admission. Exceptions to the minimum 3.00 grade-point average may be made for students with special backgrounds, abilities, and interests at the discretion of the program. Applicants will be accepted up to the number of places available for new students. GRE scores are not required for admission.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of Engineering (M.Eng.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

At least 31 credits at the 400, 500, or 800 must be earned, with at least 18 at the 500 or 800 level, and at least 6 at the 500 level. Of these, 22 must be from lecture/laboratory courses approved by the department.

Code	Title	Credits
Required Courses		
ESC 514	Engineering Science and Mechanics Seminar	1
or EMCH 514	Engineering Science and Mechanics Seminar	
Select 3 credits in each of the following areas:		12
Analysis		
Fields		
Motion		
Materials Performance/Reliability or Materials Processing/Structure/Characterization		
Select 3 additional credits from any one of the four categories above		3
Electives		
Select 12 elective credits		12
Culminating Experience		
ESC 596	Individual Studies	3
or EMCH 596	Individual Studies	
Total Credits		31

A scholarly written report on a developmental study involving at least one area represented in the course work must be written while enrolled in either ESC 596 or EMCH 596. This scholarly paper should reflect the high quality of research required to meet the Engineering Science and Mechanics M.Eng. degree standards, as determined by the ESM Graduate Officer and the ESM Graduate Curriculum Committee.

A 3.0 minimum grade point average is required to maintain good academic standing and for graduation.

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Thesis Track

At least 32 credits at the 400, 500, 600, or 800 level must be earned, with at least 18 credits at the 500 and 600 levels combined, and 24 credits must be from 400- and 500-level lecture/laboratory courses approved by the department. No more than 6 credits may be earned from 400-level courses.

Code	Title	Credits
Required Courses		
Select 3 credits in the area of Mathematical Methods in Engineering (EMCH 524A, or an equivalent or more advanced course)		3
Select 3 credits in the area of Mechanics		3
Select 3 credits in the area of Materials		3
Select 3 credits in the area of Engineering Science		3
EMCH 514	Engineering Science and Mechanics Seminar	2
or ESC 514	Engineering Science and Mechanics Seminar	
Electives		12
Culminating Experience		
Select 6 credits of thesis research:		6
EMCH 600	Thesis Research	
EMCH 610	Thesis Research Off Campus	
ESC 600	Thesis Research	

ESC 610	Thesis Research Off Campus	
Total Credits		32

A thesis is required and at least 6 credits of thesis research must be included in the student's program of study. The thesis must be a well-organized account of research undertaken by the student and must show initiative and originality. The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School, and the student must pass a thesis defense.

A 3.0 minimum grade-point average is required to maintain good academic standing and for graduation.

Non-Thesis Track

At least 32 credits at the 400, 500, 600, or 800 level must be earned, with at least 18 credits at the 500 level, and 27 credits must be from 400- and 500-level lecture/laboratory courses approved by the department. No more than 6 credits may be earned from 400-level courses.

Code	Title	Credits
Required Courses		
EMCH 524A	Mathematical Methods in Engineering (or an equivalent or more advanced course)	3
EMCH 514 or ESC 514	Engineering Science and Mechanics Seminar Engineering Science and Mechanics Seminar	2
Electives		24
Culminating Experience		
ESC 596 or EMCH 596	Individual Studies Individual Studies	3
Total Credits		32

The student is required to complete an independent research experience resulting in a scholarly paper, for which 3 credits of ESC 596 or EMCH 596 will be earned. This scholarly paper should reflect the high quality of research required to meet the Engineering Science and Mechanics M.S. degree standards, as determined by the ESM Graduate Officer and the ESM Graduate Curriculum Committee.

A 3.0 minimum grade-point average is required to maintain good academic standing and for graduation.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The Ph.D. ESMCH degree is conferred in recognition of high attainment and productive scholarship. Students may enter the Ph.D. program after completing an M.S. degree or directly from the B.S. degree. Students entering with a M.S. degree take 18 graduate course credits, 3 credits of seminar, and a minimum of 6 and up to 12 research credits.

The minimum number of course credits required for students entering the Ph.D. program with a baccalaureate degree:

A student must earn at least 27 course credits in 400- and 500-level lecture/laboratory courses approved by the department, and 5 credits in a graduate seminar (EMCH 514/ESC 514). No more than 6 of the 27 course credits can be in 400-level courses. As part of the 27 course credits, at least 3 will be in an advanced mathematics course (EMCH 524A or equivalent). Furthermore, at least one course (of at least 3 credits each) must be taken from each the following three categories: Mechanics,

Materials, and Engineering Science (a list of the courses in these categories is provided in the Graduate Programs Guide of the Engineering Science and Mechanics Department).

A minimum of 15 course credits must be in the major (courses with EMCH and/or ESC prefixes).

Twelve credits of letter grade Thesis Research with EMCH 600/ESC 600 designation are required. Students are allowed to register for EMCH 600/ESC 600 credits beyond the 12 required, but these credits will receive a grade of "R" if successfully completed. Students are allowed to register for EMCH 600/ESC 600 credits only before passing the Comprehensive Examination, after which they must register for EMCH 601/ESC 601 for 0 credits.

The student must demonstrate English competency, and pass a qualifying examination, a comprehensive examination, and a final oral examination. A doctoral dissertation on an appropriate topic is required. It must be a well-organized account of research undertaken by the student and show initiative and originality. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School. A minimum grade-point average of 3.00 for work done at the University is required for admission to the qualifying examination, the comprehensive examination, and the final oral examination, and for graduation. Graduate Council requires the student to have a high level of competence in the reading, writing, listening, and speaking of English before the Comprehensive Examination is scheduled.

Integrated Undergrad-Grad Programs

Integrated B.S. in Engineering Science And M.S. in Engineering Science and Mechanics

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Engineering Science with the M.S. in Engineering offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- University Park

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The flexibility and strength in fundamentals of the Engineering Science curriculum provides an opportunity for Engineering Science undergraduate students to participate in the ESM Integrated Undergraduate Graduate (IUG) program. The IUG program promotes the interchange of ideas across all branches of the scientific and engineering disciplines from both a theoretical and experimental perspective. Students in the integrated degree program are expected to pursue interdisciplinary studies in areas that encompass nano- and bionanotechnology, advanced materials, electromagnetic, mechanics, microelectronics, nanoelectronics and bioelectronics, neural engineering, photonics and photovoltaics (among others) and they are expected to embrace multidisciplinary perspectives across departmental, College, and University boundaries.

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Application for IUG status may be made in the fifth or subsequent semesters. Students must apply to the program via the Graduate School application for admission (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet all the admission requirements of the Graduate School and the Engineering Science and Mechanics graduate program for the Master of Science degree. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.

In consultation with an adviser, students must prepare a plan of study appropriate to this integrated program, and must present their plan of study to the head of the graduate program or the appropriate committee overseeing the integrated program prior to being admitted to the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.S. in Engineering Science are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.S. degree are listed on the Degree Requirements tab. If students accepted into the IUG program are unable to complete the M.S. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
EMCH 400	Advanced Strength of Materials and Design	3
ESC 419	Electronic Properties and Applications of Materials	3
EMCH 407	Computer Methods in Engineering Design	3
ESC 404	Analysis in Engineering Science	3
EMCH 524A	Mathematical Methods in Engineering	3
ESC 501	Solar Cell Devices	3
ESC 551	High Power Energy Storage	3

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses, the graduate thesis, and credits associated with the

culminating experience for the graduate degree cannot be double-counted.

Joint Degrees

Joint M.D./Ph.D. with the College of Medicine

Requirements listed here are in addition to requirements listed in GCAC-211 Joint Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-211-joint-degree-programs/>).

Admission Requirements

All students must process an application via the American Medical College Application Service and be accepted for admission by the M.D./Ph.D. admissions committee. Admission to the program requires a minimum GPA of 3.5 and a Medical College Admission Test (MCAT) score of 32. Exceptions to the minimum requirements may be made at the discretion of the program for students with special backgrounds, abilities, and interests. Applicants will be accepted up to the number of places available for new students. Students must successfully complete Years M1 and M2 and Step 1 of the United States Medical Licensing Examination (USMLE) before entering the graduate degree program. All requirements for the Ph.D. degree must be completed prior to Year M3 of medical studies.

Students must apply to the Graduate School (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>) for admission to the graduate program. Applicants holding undergraduate degrees in engineering, the mathematical sciences, mathematics, engineering science, and materials science and engineering who present a minimum 3.5 grade-point average will be considered for admission. Exceptions to the minimum 3.5 grade-point average may be made at the discretion of the program for students with special backgrounds, abilities, and interests. Applicants will be accepted up to the number of places available for new students.

All program-specific documents for admission (e.g., transcripts, letters of recommendation, etc.) must be submitted by all applicants.

Degree Requirements

The Joint M.D./Ph.D. Program in Engineering Science and Mechanics (M.D./Ph.D., ESMCH) will form the basis for an interdisciplinary, transformational program that will educate a new generation of Physician Engineering Scientists, working at the frontiers of clinical and translational research. This Joint Degree Program responds to the national call to expedite the incorporation of clinical and translational research into improved healthcare.

Students in the Joint M.D./Ph.D. Program in Engineering Science and Mechanics will complete 4 years of medical studies (designated years M1 through M4) at the Medical School, College of Medicine, and 3 or more years of Graduate Study (designated years G1 through G3 or GX) in the Engineering Science and Mechanics (ESM) Department.

Joint M.D./Ph.D. candidates should apply to the Ph.D. program in Engineering Science and Mechanics in M2. After successfully completing the first 2 years of medical school, including all required rotations and Step 1 of the United States Medical Licensing Examination (USMLE), the candidate will be admitted to the Ph.D. program in Engineering Science and Mechanics.

Students will complete all degree requirements for the Ph.D. Degree in Engineering Science and Mechanics, including SARI (Scholarship and Research Integrity) training for the Responsible Conduct of Research

(RCR) that must be met by students admitted to the program with either a baccalaureate or a master's degree, with the following exceptions:

- if students accepted into the joint degree program are unable to complete the M.D. degree, they are still eligible to receive the Ph.D. degree if all Ph.D. requirements have been satisfied;
- students admitted to the program with a baccalaureate degree will be allowed to double count 9 professional credits toward graduate course credit for the Ph.D. degree; and,
- students admitted to the program with a master's degree will be allowed to double count 7 professional credits toward graduate course credit for the Ph.D. degree.

Students will complete all requirements for the M.D. Degree that must be met by students admitted to the program with either a baccalaureate or master's degree, with the following exceptions:

- baccalaureate degree holders will be allowed to double count 10 research credits (ESC 600/EMCH 610) toward professional credits for the M.D. degree; and,
- master's degree holders will be allowed to double count 5 research credits (ESC 600/EMCH 610) applied to the Ph.D. ESMCH degree toward professional credits for the M.D. degree.

Students may take the qualifying examination after completing 18 credits of approved graduate course work.

- master's degree holders accepted into the Joint M.D./Ph.D. program may take the qualifying examination in the Spring Semester of Year G1, but no later than the Fall Semester of G2.
- baccalaureate degree holders accepted into the Joint M.D./Ph.D. program may take the qualifying examination within 3 semesters of entry into the Ph.D. program (expected to be the Fall Semester of G2).

Following completion of the Ph.D. dissertation, students will return to medical school to complete Years M3 and M4 of the professional M.D. degree.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Research and Teaching Assistantships (half time) are granted to a majority of graduate students in good academic standing. Financial supported is ordinarily limited to three semesters for full-time master's degree students, and six semesters for full-time Ph.D. students.

In addition to the fellowships, traineeships, graduate assistantships, or other forms of financial aid described in the link above, ESM has a number of scholarships that may provide graduate support. Students who wish to request consideration for these funds should notify the ESM Coordinator for Alumni, Development and Advancement in 212 Earth & Engineering Science Building.

Theodore Holden Thomas Jr., Memorial Scholarship

To provide financial assistance to undergraduate or graduate students who display outstanding ability and have enrolled in the Department of Engineering Science and Mechanics.

Sabih and Guler Hayek Graduate Scholarship in Engineering Science and Mechanics

To provide recognition and financial assistance to outstanding graduate students enrolled or planning to enroll in the Department of Engineering Science and Mechanics.

Dr. Richard Llorens Graduate Award in Engineering Science and Mechanics

To provide recognition and financial assistance to graduate students pursuing a degree in Engineering Science and Mechanics who have achieved academic excellence.

Richard P. McNitt Scholarship in Engineering Science and Mechanics

To provide financial assistance to undergraduate or graduate students enrolled in the Department of Engineering Science and Mechanics who have achieved superior academic records or who manifest promise of outstanding academic success.

DR. JOHN T. FRASIER GRADUATE FELLOWSHIP

To recruit and recognize outstanding students enrolled in a graduate degree offered by the Department of Engineering Science and Mechanics.

DEPARTMENT OF ENGINEERING SCIENCE AND MECHANICS GENERAL SCHOLARSHIP

To provide recognition and financial assistance to outstanding graduate and undergraduate students enrolled or planning to enroll in the Department of Engineering Science and Mechanics.

MATTHEW GEORGE WORKMAN SCHOLARSHIP IN THE DEPARTMENT OF ENGINEERING SCIENCE AND MECHANICS IN THE COLLEGE OF ENGINEERING

To provide recognition and financial assistance to students enrolled in the Engineering Science, Engineering Mechanics, or Engineering Science and Mechanics degree programs in the College of Engineering at Penn State University Park.

Dale and Jeanne Mosier Fund for Excellence in Engineering Science and Mechanics

Robert A. Sebrosky Graduate Fellowship in Engineering Science and Mechanics

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Engineering Mechanics (EMCH) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/emch/>)

Learning Outcomes

Master of Science (M.S.)

1. **KNOW:** Demonstrate a mastery of core principles and methods in mechanics, materials, and engineering science.
2. **APPLY/CREATE:** Apply engineering problem formulation, planning, organization and implementation of appropriate methods of analysis and solutions.
3. **COMMUNICATE:** Effectively communicate technical knowledge, including ideas, designs, data analysis, findings, or decision justification in written, graphical and oral presentation formats.
4. **THINK:** Critically and creatively conceptualize and evaluate engineering problem formulations, analyses and solutions.
5. **TEAMWORK:** Collaborate in a collegial and ethical manner with other professionals within their field and with diverse scientific and technical backgrounds.
6. **PROFESSIONAL PRACTICE:** Demonstrate a knowledge and the ability to practice the professional standards of engineering and professional behavior.

Doctor of Philosophy (Ph.D.)

1. **KNOW:** Graduates will demonstrate an in-depth knowledge of the core theories and methods within one or more sub-specialties in the fields of engineering science and mechanics. The core demonstration will include the application of physics, advanced mathematics and engineering principles to problems in mechanics, materials, bionanotechnology, nanoscience and neuroscience.
2. **APPLY/CREATE:** Graduates will be able to synthesize theory, literature and experimental results to generate new concepts, designs or hypotheses in engineering science and mechanics.
3. **APPLY/CREATE:** Graduates will be able to carry out independent and original research studies that address current problems in the multi-disciplinary field of engineering science and mechanics.

4. **COMMUNICATE:** Graduates will be able to convey ideas or arguments in clear, concise, well organized papers and proposals as well as in formal, oral presentations.
5. **THINK:** Graduates will be able to critically analyze work by others in their field of specialty.
6. **PROFESSIONAL PRACTICE:** Graduates will demonstrate the ability to collaborate in a collegial and ethical manner with other professionals within their field and/or with diverse scientific backgrounds.

Contact

Campus	University Park
Graduate Program Head	Albert Eliot Segall
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Albert Eliot Segall
Program Contact	Tammy L Coval 212 EES Building Pennsylvania State University University Park PA 16802 tlc21@psu.edu (814) 863-4586
Program Website	View (http://www.esm.psu.edu/)

Engineering Systems

Graduate Program Head	Vahid Motevelli
Program Code	ENGSY
Campus(es)	Harrisburg (Ph.D)
Degrees Conferred	Doctor of Philosophy (Ph.D)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=ENGSY)

The Ph.D. program in Engineering Systems offers an interdisciplinary research opportunity centered in engineering and focused on engineering systems. This program prepares students to meet the challenges, problems, and opportunities of the twenty-first century. An engineering system is defined as a set of engineering processes or devices functioning together as parts of a mechanism or an interconnected network. This program intends to provide a new pathway for interdisciplinary engineering education and research that focuses on the understanding and development of next-generation systems. As its defining characteristic, the program offers an interdisciplinary education that combines course work and doctoral research that cut across disciplines with a focus on engineering systems. More specifically, students may develop expertise in the traditional civil, environmental, electrical, mechanical engineering, and computational systems; however, they are expected to apply their doctoral research to engineering systems. Students in this program can complement their studies with courses and research that provides a broad view of engineering systems. Because of this approach, graduates of the program will be fully prepared to enter "Ph.D. required" positions in fields related to civil, environmental, electrical, mechanical engineering, and computing. The interdisciplinary nature of this program also prepares students to enter other exciting growth areas within academia, the public sector, and the larger economy. These areas include built environments, smart cities, transportation networks, artificial intelligence, medical systems, and many others. This Ph.D. program is the only interdisciplinary doctoral program of its kind in South Central Pennsylvania.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Applicants to the Ph.D. program in Engineering Systems are required to have completed a bachelor's degree in engineering from an institution holding accreditation as outlined in GCAC-301 Qualifications for Admission, with a minimum 3.0 grade-point average (on a 4.0 scale), and a master's degree in engineering or another STEM field. Students with a master's degree in engineering or other STEM field, but with a bachelor's degree from a non-engineering STEM field, may be admitted on a provisional basis pending successful completion of specific engineering core courses per recommendation of the admissions committee for the Ph.D. in Engineering Systems. Potential applicants may contact the Ph.D. program director to discuss their preparation and credentials to determine if an application to the program is advised.

Applicants are required to submit:

- Scores from the GRE General Test
- Three letters of reference
- A personal statement sharing relevant experience and goals
- A resume
- Official transcripts from all post-secondary institutions attended

Degree Requirements

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The Ph.D. program in Engineering Systems requires a minimum of 36 credits at the 500, 600, or 800 level post-master's degree. The 36 credits are divided into required course work (minimum of 21 credits) and dissertation research credits (minimum of 15). The 15 dissertation research credits must include a minimum of 12 credits of ENGR 600. Students may take ENGR 600 or ENGR 610 after achieving candidacy to fulfill the requirement for 15 dissertation research credits.

The 21 credits of required course work are divided into the following three categories:

Code	Title	Credits
Required Courses		
<i>Common Core</i>		
ENGR 502	The Smart City	3
ENGR 503	Interdisciplinary Research Methods in Engineering	3
SYSEN 507	Systems Thinking	3

Courses within the Student's Specialty (minimum of 6 credits)

Students must take a minimum of 6 credits at the 500 or 800 level in the following areas: electrical engineering (EE), mechanical engineering (ME), civil engineering (CE), environmental engineering (ENVE), engineering mechanics (EMCH), engineering design (EDSGN), industrial engineering (IE), material science (MATSE), mathematics (MATH), or computer science (COMP). Additional credits (i.e., courses taken above 6 credits) may be at the 400 level. The courses that will satisfy this requirement can be chosen from a list of approved courses maintained by the graduate program office.

Cognate Courses (minimum of 6 credits)

Students will take a minimum of 6 credits at the 500 or 800 level of interdisciplinary cognate courses. Cognate courses must be complementary to a student's chosen dissertation research area. Interdisciplinary cognate courses play a crucial role in helping this Ph.D. program achieve its objective of offering an interdisciplinary education. Advisers will also be responsible for determining whether a given course contains sufficient complementary content and prepares the students for their chosen dissertation topic to qualify as a cognate course.

Dissertation Research

ENGR 600	Thesis Research	15
Total Credits		36

A student must pass the Ph.D. qualifying examination prior to the start of the third regular semester after entering the program. After completion of most of the course work and meeting the English competency requirement, students must pass the Ph.D. comprehensive examination.

A dissertation must be completed under the direction of the Ph.D. committee and the results must be successfully defended in the final oral examination. To earn the Ph.D. degree, doctoral candidates must write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by

graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Students will demonstrate broad knowledge of the several varieties of engineering systems, including their inter-relationships, in their course work, qualifying examination, comprehensive examination, and dissertation.
2. Students will demonstrate specialized knowledge within the engineering fields (civil, environmental, electrical, mechanical, and computer engineering) in their course work, qualifying examination, comprehensive examination, and dissertation.
3. Students will exhibit mastery of the interdisciplinary mindset by applying the knowledge, theories, skills, and methods of two or more disciplines acquired during course work in their independent research.
4. Students will identify areas in their field of study in which they can contribute original research, create new knowledge, and develop solutions to real-world problems.
5. Having studied ethics in a required course, students will choose ethical courses of action in their research projects.
6. Students will develop oral and written communication skills by sharing their research findings in their dissertations, conference presentations, and papers published in academic journals and proceedings.
7. Students will demonstrate the ability to assist faculty in classroom instruction and laboratory exercises.
8. Graduates will exhibit their acquisition of critical thinking skills by independently analyzing and critiquing published scholarship and by assessing its implications in the world.
9. Graduates will become prepared to be leaders in society who are capable of overseeing projects and addressing problems in an effective and ethical way.

Contact

Campus	Harrisburg
Graduate Program Head	Vahid Motevalli
Program Contact	Shelly Sneeringer mms8117@psu.edu (717) 948-6097
Program Website	View (https://harrisburg.psu.edu/science-engineering-technology/engineering-systems-phd/)

Engineering, Law, and Policy

Graduate Program Head	David Mazyck
Program Code	MELP
Campus(es)	University Park (M.Eng.)
Degrees Conferred	Master of Engineering (M.Eng.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=MELP)

The MELP program will prepare students from diverse backgrounds in engineering to address societal change, the rapid progress of technology

and globalization, and become innovative leaders of change. MELP students will be versed in science and technology policy, legal and regulatory policy, complex systems design, and anticipating technology trends. They will acquire strong technical and analytical skills in systems thinking and an understanding of the convergence between engineering, law and policy for the successful development and implementation of technology-based strategies and solutions.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The student cohort should reflect today's international engineering environment, with selective admittance. The admission requirements include:

B.S. or master's degree in Engineering (including Computer Science or related technical field) with a 3.0 minimum undergraduate GPA (or equivalent). Exceptions to the minimum

- 3.0 grade-point average may be made for students with special backgrounds, abilities, and interests. Applicants will be accepted up to the number of places available for new students.
- Submission of a completed online Graduate School application for admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>), including a Statement of Purpose, resume, and three letters of recommendation.
- Submission of official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>).

Applicants for fall admission who wish to be considered for financial aid should complete the application process prior to DECEMBER 15 of the preceding year.

Core Application Packet

- Completed official online Graduate School application for admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>), and payment of nonrefundable application fee.
- Statement of purpose: a 2-3 page essay articulating interest in the program and career and educational goals. Statement of purpose should include:
 - An introduction about yourself, indicating interests, goals, and how the M.Eng. in Engineering, Law and Policy degree can help further them.
 - Any unique experiences, skills, professional experience, and/or perspectives you will bring to the distinctive learning environment and how these will enhance the Law, Policy, Engineering (LPE) community. Professional engineering experience is preferred. Applicants wishing to enter the program directly from an undergraduate degree may demonstrate experience through summer internships, summer employment, co-op experiences or experience within professional societies or student-led organizations that lead engineering projects or activities.
 - Discuss what makes you a strong candidate for the M.Eng. in Engineering, Law and Policy. Make use of supporting examples to demonstrate.

- Make certain the above points are linked with continuity and focus, and demonstrate written communication skills.
- Vita or Résumé. Provide a current résumé or curriculum vitae, which includes your education, employment history, awards and accolades, national and international exposure, publication credits, and leadership roles in any volunteer and/or extracurricular activities.
- Three (3) letters of recommendation that attest to your readiness for graduate study and document the requisite minimum of one year of work experience. Letters must be submitted through the online application. Within the online application you will be asked to enter the names and email addresses of three individuals who will be providing your recommendation. Those individuals will receive a note via email asking them to complete a brief form that will serve as your recommendation. Please inform all recommenders they must submit the form in order for your application to be complete. Recommendations that come from former supervisors should comment on and provide examples of your performance as an intern and/or an employee, including the nature of your work and what you contributed to the company or organization. Letters from personal acquaintances or those who are not familiar with your academic or professional qualifications are not helpful to the admissions committee.
- Official transcripts from all post-secondary institutions attended. (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>)
- GRE (optional): GRE scores are not required. Applicants do not need to submit GRE scores to be considered for admission, financial aid or merit-based scholarships. Applicants wishing to submit GRE scores are welcome to should they choose. However, not submitting GRE scores will not negatively impact your application in any way. If you decide to submit GRE, only scores received directly from the testing service will be accepted.

Degree Requirements

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The Master of Engineering (M.Eng.) degree in Engineering, Law and Policy is a non-thesis professional master's degree that provides training for advanced professional practice. To receive the M.Eng. in Engineering, Law and Policy (MELP) a student must complete a minimum of 30 credits at the 400, 500, or 800 level, with a minimum of 18 credits at the 500 or 800 level, and at least 6 credits at the 500 level. The MELP residential program aims to provide Penn State graduates, as well as other U.S. and international students, with a competitive advantage when seeking employment at the nexus of science and technology policy, policy analysis, complex systems design, and regulatory compliance. This program also offers experienced engineers, as well as government and industry employers interested in supporting the professional growth of their engineers, the knowledge and skills to be versed in technology policy, regulatory policy analysis and advising, and emerging technology trends for business growth.

Students that pursue the MELP degree will attain broad, interdisciplinary competence and technical, policy and regulatory skills in as little as two semesters of intensive study, one year of full time study, or two years of part time study.

Total required credits for the MELP program is 30 credits.

Code	Title	Credits
Required Courses		
INTAF 502	Science, Technology, and International Policy	3
EDSGN 549	Design Decision Making	3
EDSGN 558	Systems Design	3
LPE 851	Foundations in Public Law	3
LPE 852	Foundations in Private Law	3
LPE 853	Engineering, Law, and Policy Systems	3
Electives		9
Culminating Experience		
LPE 854	Engineering, Law, and Technology Policy Practicum (Capstone Course)	3
Total Credits		30

Students must select 9 credits of electives, which may be a) electives in technical focus areas, b) general electives, or c) required core courses in the graduate certificate in International Affairs, International Security Studies, International Public Policy, International Development, or Engineering Leadership and Innovation Management. Electives will be chosen by the student based on their academic background, in consultation with their adviser or company (if they are associated with a sponsoring company) and the MELP program director. Elective courses can be chosen from a list of approved courses maintained by the graduate program office. Other courses may be approved in consultation with the adviser.

The culminating experience for the degree is a capstone course, LPE 854 Engineering, Law and Technology Policy Practicum. This course addresses current pressing issues in innovation, technology policy, and law through the eyes of policymakers. Students work on public-facing projects in interdisciplinary teams applying strategic technology policy, regulatory concepts and systems thinking to real world policy issues. The projects are tailored to meet the current research needs of particular federal and state lawmakers and agencies based on their legislative and regulatory agendas for the year. Students will analyze technology and policy options and conceive, design, and execute a technology policy research project taking into consideration the political, social and institutional context of technological systems. Students deliver an oral presentation, a technology policy tool, and a policy research paper on the project topic for relevant policymakers, seeking to assist them in their policy decision-making process. This course is designed to provide students with practical work experience, where they learn by doing.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)

- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Refer to the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students in this program are not eligible for graduate assistantships.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

Through this program, students will acquire the skills to:

1. Develop solutions to complex societal problems by applying systems thinking and principles of engineering system and integrating perspectives from law, policy, engineering, and ethics;
2. Recognize, analyze and explain the fundamental principles of advanced topics in technology, technology policy, and law;
3. Connect local, national, and global problems, resources, and solutions;
4. Use language and concepts in ways that are consistent with how the law works, explain legal reasoning and analysis, critically read and analyze legal information, and identify and avoid the unauthorized practice of law;
5. Identify, interpret and explain interdisciplinary and trans-disciplinary perspectives and find common ground among them on which to build solutions;
6. Distinguish, analyze and model engineering systems, legal systems, and policymaking systems; communicate the interplay between such systems in regard to emerging technologies and their integration into existing systems;
7. Perform productively on an interdisciplinary team where members together provide leadership, and create a collaborative and inclusive environment;
8. Communicate effectively across disciplines with a range of audiences and stakeholders.

Contact

Campus	University Park
Graduate Program Head	David William Mazyck
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	CHRISTINE KIRCHHOFF
Program Contact	Mariah L Germello mld5449@psu.edu (814) 865-2771

English

Graduate Program Head	Mark Morrisson
Program Code	ENGL
Campus(es)	University Park (Ph.D., M.A.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Arts (M.A.) Dual-Title Ph.D. in English and African American and Diaspora Studies Dual-Title Ph.D. in English and Visual Studies Dual-Title Ph.D. and M.A. in English and Women's, Gender, and Sexuality Studies Integrated B.A. in English and M.A. in English
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=ENGL)

The graduate program does not offer a stand-alone M.A. degree; the M.A. is linked to the Ph.D. program, and students completing the M.A. must be approved for continuation into the doctoral segment of the program. Students may choose from a variety of courses in English literature and language, rhetoric and composition, and theory/cultural studies.

The department offers an excellent college-level teacher-training program, and all graduate students in English have the opportunity to serve as teaching assistants. Students usually begin by teaching basic composition courses, but there are opportunities for advanced students to teach courses in business writing, technical writing, fiction writing, poetry writing, literature, and humanities, and to serve as tutors in the Writing Center.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Applicants should have a junior/senior grade-point average of 3.50 (on a 4.00 scale), although exceptions may be made for students with special backgrounds, abilities, and interests. Applicants should have a strong background in English courses: 18 credits beyond freshman composition at a minimum, but the department prefers at least 24 credits. Applicants must submit three letters of recommendation, a writing sample indicating their ability to do analytical or original work, and a statement of their professional goals. GRE scores will not be accepted.

Degree Requirements

Master of arts (M.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Candidates for the M.A. take at least 30 credits of course work in English, with a minimum of 18 credits of 500-level courses, including:

Code	Title	Credits
Required Courses		
ENGL 501	Materials and Methods of Research	3
	1 course in literary theory or rhetoric	3
	2 courses in literature in English prior to 1800	6
	2 courses in literature in English after 1800	6
Electives		6
Culminating Experience		
ENGL 596	Individual Studies (in which students complete their culminating master's paper)	6
Total Credits		30

In addition, M.A. candidates must demonstrate reading knowledge of one of the following languages: French, German, Italian, Russian, Spanish, Latin, and Classical Greek. Other languages may be substituted with the approval of the Graduate Studies Committee.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The Ph.D. degree does not require a specific number of credits although all students are required to have completed:

- ENGL 501 (or the equivalent),
- one course in rhetoric or theory,
- two courses in periods before 1800,
- and two courses in periods after 1800.

Language requirement: Ph.D. candidates must demonstrate reading knowledge of one of the following languages: French, German, Italian, Russian, Spanish, Latin, and Classical Greek. Other languages may be substituted with the approval of the Graduate Studies Committee.

With the help of departmental graduate advisers, students select a program of seminars or reading courses. To complete their programs, students must pass a Ph.D. qualifying examination and pass a comprehensive examination (consisting of both written and oral components); and write a doctoral dissertation. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School, and the student must pass a final oral examination.

Dual-Titles

Dual-Title Ph.D. in English and African American and Diaspora Studies

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/).

Admission Requirements

Students must apply and be admitted to the graduate program in English and the Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the African American and Diaspora Studies dual-title program. Refer to the Admission Requirements section of the African American and Diaspora Studies Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/african-american-diaspora-studies/>). Doctoral students must be admitted into the dual-title degree program in African American and Diaspora Studies prior to taking the qualifying examination in their primary graduate program.

In addition to the admission requirements set forth by the Graduate Council and the Department of English, students will be admitted to the dual-title degree program in African American and Diaspora Studies by an admissions committee of African American and Diaspora Studies faculty. Students enrolled in the English Department can apply for admission to the dual-title degree prior to taking the qualifying exam.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the Ph.D. in English. In addition, students must complete the degree requirements for the dual-title in African American and Diaspora Studies, listed on the African American and Diaspora Studies Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/african-american-diaspora-studies/>).

Language Requirement

As required by the Department of English, students must demonstrate reading proficiency in at least one language other than English no later than the third semester of residency (not including summer semester).

Qualifying Examination

The dual-title field must be fully integrated into the qualifying exam for the doctoral program. The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from English and must include at least one Graduate Faculty member from the African American and Diaspora Studies program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. In addition, students in the dual-title Ph.D. in African American and Diaspora Studies will be required to present to their committee a portfolio of work in African American and Diaspora Studies which includes:

- a statement of the student's interdisciplinary research interests,
- a program plan,
- and samples of writing that indicate the student's interest in questions taken up by scholars of African American and Diaspora Studies.

Because students must first be admitted to a graduate major program of study before they may apply to and be considered for admission into a dual-title graduate degree program, dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

Ph.D. Committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/>).

gcac/gcac-600/phd-dissertation-committee-formation/), the Ph.D. committee of an English and African American and Diaspora Studies dual-title Ph.D. student must include at least one member of the African American and Diaspora Studies Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the committee representing English is not also a member of the Graduate Faculty in African American and Diaspora Studies, then the committee member representing African American and Diaspora Studies must be appointed as co-chair.

Comprehensive Exam

The African American and Diaspora Studies Graduate Faculty member on the student's Ph.D. committee is responsible for developing and administering the African American and Diaspora Studies portion of the student's comprehensive exam. The exam must incorporate written and oral components in African American and Diaspora Studies based on the student's thematic or regional area of interest and specialization in African American and Diaspora Studies. The African American and Diaspora Studies portion of the exam will include the following components:

- broad history of the field,
- contemporary theory and debates,
- and either sexual and gender politics or a topic related to the student's specific area of interest.

Dissertation and Final Oral Examination

The candidate must complete a dissertation on a topic that reflects their original research and education in both English and African American and Diaspora Studies. In order to earn the dual-title Ph.D. degree, the dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School, and the student must pass a final oral examination.

Dual-Title Ph.D. in English and Visual Studies

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Students must apply and be admitted to the graduate program in English and the Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Visual Studies dual-title program. Refer to the Admission Requirements section of the Visual Studies Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/visual-studies/>). Doctoral students must be admitted into the dual-title degree program in Visual Studies prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the Ph.D. in English. In addition, students must complete the degree requirements for the dual-title in Visual Studies, listed on the Visual Studies Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/visual-studies/>).

Language Requirement

As required by the Department of English, students must demonstrate reading proficiency in at least one language other than English no later than the third semester of residency (not including summer semester).

Qualifying Examination

The dual-title field will be fully integrated into the qualifying exam for the doctoral program. The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from English and must include at least one Graduate Faculty member from the Visual Studies program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. In addition, students in the dual-title Ph.D. in Visual Studies will be required to present to their committee a portfolio of work in Visual Studies, including:

- a statement of the student's interdisciplinary research interests,
- a program plan,
- and samples of writing that indicate the student's interest in questions related to the Visual Studies.

Because students must first be admitted to a graduate major program of study before they may apply to and be considered for admission into a dual-title graduate degree program, dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

Ph.D. Committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of an English and Visual Studies dual-title Ph.D. student must include at least one member of the Visual Studies Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the committee chair does not represent Visual Studies, the committee member representing Visual Studies must be appointed as co-chair.

Comprehensive Exam

The Visual Studies Graduate Faculty member on the student's committee is responsible for developing and administering the Visual Studies portion of the student's comprehensive exam. The exam must incorporate components addressing Visual Studies based on the student's areas of interest and specialization in the Visual Studies.

Dissertation

The candidate must complete a dissertation on a topic that reflects his or her original research and education in both English and in Visual Studies in order to earn the dual-title Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School, and the student must pass a final oral examination.

Dual-Title M.A. and Ph.D. in Women's, Gender, and Sexuality Studies

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admissions Requirements

Students must apply and be admitted to the graduate program in English and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary

program, students must apply for admission to and meet the admissions requirements of the Women's, Gender, and Sexuality Studies dual-title program. Refer to the Admission Requirements section of the Women's, Gender, and Sexuality Studies (<https://bulletins.psu.edu/graduate/programs/majors/womens-gender-sexuality-studies/>) Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/womens-studies/>). Doctoral students must be admitted into the dual-title degree program in Women's, Gender, and Sexuality Studies prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in English. In addition, students must complete the degree requirements for the dual-title in Women's, Gender, and Sexuality Studies, listed on the Women's, Gender, and Sexuality Studies (<https://bulletins.psu.edu/graduate/programs/majors/womens-gender-sexuality-studies/>) Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/womens-studies/>).

The comprehensive examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from English and must include at least one Graduate Faculty member from the Women's, Gender, and Sexuality Studies program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single comprehensive examination, containing elements of both English and Women's, Gender, and Sexuality Studies. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of and English and Women's, Gender, and Sexuality Studies dual-title Ph.D. student must include at least two members of the Women's, Gender, and Sexuality Studies Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Women's, Gender, and Sexuality Studies, a member of the committee representing Women's, Gender, and Sexuality Studies must be appointed as co-chair. The Women's, Gender, and Sexuality Studies representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in English and Women's, Gender, and Sexuality Studies. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Integrated Undergrad-Grad Programs

Integrated B.A. in English and M.A. in English

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.A. in English with the M.A. in English offered at the following campuses:

Undergraduate Degree

- Abington
- Altoona
- Bandywine
- Scranton
- York
- University Park

Graduate Degree

- University Park

The graduate portion of this IUG is currently offered as face-to-face residential instruction. While the undergraduate curriculum for this IUG may be completed at multiple campuses, the ease and feasibility of completing the integrated program may be heavily dependent upon the location of the graduate instruction. Please discuss the feasibility of completing the IUG with a representative for the graduate program before beginning the application process.

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The English B.A./M.A. Integrated Undergraduate Degree Program (ENGL IUG) is a five-year program designed for highly-qualified and motivated students seeking to improve their writing skills significantly. The integrated B.A./M.A. degree offers talented Penn State undergraduates in English a chance to acquire both a B.A. in English and an M.A. in English in five years of study. The first two years of undergraduate course work include the University General Education and Liberal Arts requirements in addition to introductory course work in the English major. Students typically will apply to the B.A./M.A. during their 5th or 6th semester and begin graduate studies in their fourth year. In the third year students are expected to take upper-level course work in English in literature, rhetoric, or creative writing. In the fourth year, students will complete the capstone course for the English major, ENGL 487W, and enroll exclusively in 400-level and graduate-level courses in creative writing. The fifth and final year of the integrated program consists entirely of graduate-level seminars. The program culminates with the submission of a master's paper that consists of the best creative work that the student has produced in his or her primary creative genre—either poetry or prose, and includes a scholarly research component.

Time of Admission to the Program

Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.

Application to the English IUG would typically occur in the junior year after a student has completed 60 credits, enrolled in the English major, and completed two English courses in creative writing.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students must apply to and meet admission requirements of the Graduate School, as well as the admission requirements for the M.A. in English, listed on the Admission Requirements tab.

Admission to the integrated B.A./M.A. program will be based on the submission of a portfolio of creative work and a plan of study to the department's Director of Graduate Studies (DGS) and the Director of the B.A./M.A. program. Applications typically will be filed during the 5th or 6th semesters of study, and applicants must have achieved a minimum of 60 credits and a 3.3 overall GPA and 3.6 GPA in English to begin the program. The English DGS will ensure that the applicant meets the minimum credit and GPA requirements for the program. The Director of the B.A./M.A. program will evaluate the quality of the student's creative work and the applicant's plan for fulfilling the requirements of the M.A. in English. The Director of the B.A./M.A. program, in consultation with the Creative Writing faculty, will have final approval for what constitutes an acceptable level of creative work and an acceptable plan for the completion of the M.A.

The application procedure requires submission of the following:

1. Support letters from faculty and administrators (addressed to the department's Director of Graduate Studies and the Director of the B.A./M.A. program)
2. A personal statement
3. Portfolio of creative work
4. A Plan of Study
5. A transcript and degree audit printed from the student information system
6. A current resume or curriculum vita
7. A copy of the completed on-line Graduate School Application (GRE scores will not be accepted).

Plan of Study and Advising

Prior to the application process, students should communicate their intent to enroll in the IUG to the English B.A. adviser and the Director of the B.A./M.A. program. The Director of the B.A./M.A. will help each student identify an appropriate series of English courses to properly prepare each student for the 500-level M.A. workshops and 500-level literature courses.

Students will be expected to maintain a minimum overall GPA of 3.3 for all undergraduate course work and a GPA of 3.6 in English (ENGL) courses throughout the IUG program of study. Failure to do so will result in the student being advised that he/she must regain a GPA of 3.3 within one semester. If the GPA is not 3.3 or higher in general undergraduate course work and 3.6 or higher in English course work after that term, the student will be dropped from the IUG.

Each student enrolled in the B.A./M.A. will meet at the beginning of each term with the Director of the B.A./M.A. to discuss their progress

through the M.A. degree and to make sure that they are following the plan established upon their admission to the B.A./M.A. program.

If the student decides not to continue on in the IUG, the student may, contingent on fulfilling all other requirements for the B.A. in English, graduate with a B.A. in English.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.A. in English are listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.A. degree are listed on the Degree Requirements tab. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
ENGL 412	Advanced Fiction Writing	3
ENGL 413	Advanced Poetry Writing	3
ENGL 415	Advanced Nonfiction Writing	3
ENGL 512	The Writing of Fiction	3
ENGL 513	The Writing of Poetry	3
ENGL 515	The Writing of Nonfiction	3

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

In addition to the fellowships, traineeships, graduate assistantships, and other forms of financial aid described in the link above, the following awards typically have been available to graduate students in English graduate programs:

Edwin Erle Sparks Fellowship in the Humanities

Available to beginning and continuing graduate students in one of the following graduate programs:

- Comparative Literature
- English
- French
- German
- History
- Linguistics
- Philosophy
- SpanishSpeech Communication

Apply to department before February 1.

Katey Lehman Fellowship

Provides approximately \$13,000 plus tuition for a year's study in poetry or fiction writing leading toward the B.A./M.A. in English or the M.F.A. in English. The Lehman Fellow will teach one course during the fellowship year. Fellowship holders are eligible for graduate assistantships with a similar stipend and tuition grant during the second year of study.

Wilma Ebbitt Award

Funding to support research in rhetoric. Number and amount of awards to be determined.

Ben Euwema Memorial Scholarship

Travel funding for graduate degree candidates; consideration will be given to all currently enrolled graduate students in English. Preference will be given to students at the Ph.D. thesis stage, particularly those who need to travel to complete their research; number of awards and amount of each will be determined each year.

Folger Institute Fellowships

Penn State is a member of the Folger Institute of Renaissance and Eighteenth-Century Studies. Graduate students in English are eligible for Folger Institute Fellowship to study in seminars and workshops at the Folger Library, Washington, D.C.

Philip Young Memorial Award

Funding to support research in American Literature. Number and amount of awards will be determined.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

English (ENGL) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/engl/>)

Learning Outcomes

Master of Arts (M.A.)

1. M.A. graduates will demonstrate broad familiarity with the scholarly subfields, historical periods, methodological approaches, and research tools of English studies.
2. M.A. graduates will demonstrate effective skills in undergraduate teaching, and upon completion of the degree will be equipped to create syllabi and teach writing courses in a variety of institutional settings.
3. M.A. graduates will demonstrate, by way of a culminating scholarly paper, the ability to analyze literary or rhetorical texts or objects using a particular theoretical or methodological approach.

Doctor of Philosophy (Ph.D.)

1. Ph.D. students will demonstrate fundamental knowledge of the methods, methodologies, and scholarly theories relevant to their chosen subfield(s)/areas of specialization in English studies, and will be able to engage substantively with critical conversations in those subfields within a variety of milieux, including conferences, seminars, publication platforms, and teaching venues.
2. Ph.D. students will use professional standards of the field of English studies to develop and carry out an ambitious, argument-driven research plan that will issue in a book-length work of scholarship (the dissertation).
3. Ph.D. students will communicate the importance of their dissertation project in spoken and written forms, including the dissertation defense.
4. Ph.D. students will use current standards of pedagogical practice and theory to create syllabi for and to teach writing studies courses at multiple college levels. When feasible, students will create a syllabus for and a teach course related to their areas of scholarly expertise.
5. Ph.D. students will become familiar with a range of diverse career applications for the English doctoral degree, both within and outside of the university setting.

Contact

Campus	University Park
Graduate Program Head	Mark Stewart Morrisson
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Janet Wynne Lyon
Program Contact	Cheryl Mohr English Graduate Office 430 Burrowes Building University Park PA 16802 cam84@psu.edu (814) 863-3069
Program Website	View (http://english.la.psu.edu/)

Enterprise Architecture and Business Transformation

Graduate Program Head	Carleen Maitland
Program Code	EABT
Campus(es)	World Campus (M.E.A.)
Degrees Conferred	Master of Enterprise Architecture (M.E.A.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=EABT)

The Master of Enterprise Architecture (M.E.A.) in Enterprise Architecture and Business Transformation is a unique program designed for professionals aspiring to advance to roles with enterprise wide scope and authority, such as that embodied by an enterprise architect. The M.E.A. in EABT provides a comprehensive educational experience in the principles and practice of enterprise architecture (EA) and integrates both business and enterprise technical knowledge. The program includes courses in:

- enterprise architecture foundations,
- business architecture,
- information technology architecture,
- enterprise security and risk architecture,
- organizational leadership,
- strategic management, and
- financial management.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Since the program is multidisciplinary in nature, students from many disciplines may be acceptable for entry into the program. The most qualified applicants will be accepted in the program until all available spaces for new students are filled.

Consideration for admission into the program will be granted to individuals who meet one of the following sets of criteria:

- An approved baccalaureate degree with a minimum grade point average of 2.75 or above, (on a 4.0 scale) a minimum of five years of

relevant work experience, three letters of reference, and a personal statement of relevant experience and goals.

- An approved baccalaureate degree with a minimum of a 3.00 (on a 4.00 scale) grade point average, a minimum of two years of relevant work experience, three letters of reference, and a 1-3 page personal statement of relevant experience and goals.
- A graduate degree, a minimum of one year of relevant work experience, three letters of reference, and a 1-3 page personal statement of relevant experience and goals.
- An approved baccalaureate degree, successful completion of three courses in the program with a minimum of a 3.50 (on a 4.00 scale) grade point average as a non-degree graduate student, at least two years of relevant work experience, and a 1-3 page personal statement of relevant experience and goals.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of Enterprise Architecture (M.E.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The Master of Enterprise Architecture in Enterprise Architecture and Business Transformation program requires a minimum of 33 credits at the 400, 500, or 800 level. At least 18 credits must be at the 500 or 800 level, with at least 6 credits at the 500-level. Up to 10 graduate credits may be transferred in from a regionally accredited institution (subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>)). A student will take 27 credits of required courses. The remaining 6 credits are selected from a list of approved elective courses. The courses are delivered online through Penn State World Campus. The program is highly flexible and is designed to meet the different needs of students and organizations. With online delivery, the professional master program can easily fit into the work schedule of professionals from around the globe.

Code	Title	Credits
Required Courses		
EA 871	Enterprise Architecture Foundations I	3
EA 873	Enterprise Modeling	3
EA 874	Enterprise Information Technology Architecture	3
EA 876	Architecting Enterprise Security and Risk Analysis	3
BA 809	Strategic Business Architecture	3
MBADM 571	Global Strategic Management	3
Choose 2 courses from the following list:		
MGMT 831	Strategy Implementation and Organizational Change	6
MBADM 816	Managing and Leading People in Organizations	
MBADM 820	Financial Management	
Electives		

Elective concentrations are available in Supply Chain, Security Architecture, Business Architecture, and Project Management. A list of courses required for each concentration is maintained by the graduate program office.

Culminating Experience

Each degree candidate must complete a culminating experience. The student may choose to complete either a culminating project or the capstone course.

Culminating Project

EA 594 Research Topics
or IST 594 Research Topics

Capstone Course

EA 878 Enterprise Architecture Leadership

Total Credits **33**

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Enterprise Architecture (EA) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/ea/>)

Learning outcomes

1. **KNOW:** Demonstrate knowledge of effective Enterprise Architecture concepts that align with business strategy.

2. **APPLY/CREATE:** Design, develop and apply an effective risk strategy across the enterprise.
3. **COMMUNICATE:** Communicate the value of Enterprise Architecture with business and technology stakeholders.
4. **THINK:** Graduates will be able to think analytically and critically about the application of concepts and methods in enterprise architecture frameworks.
5. **PROFESSIONAL PRACTICE:** Understand the importance of effective modeling and project portfolio management and conduct themselves in the highest ethical values and standards in the management of the Enterprise Architecture process.

Contact

Campus	World Campus
Graduate Program Head	Carleen Maitland
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	David Joseph Fusco
Program Contact	Chrissie Fitzgerald College of Information Sciences and Technology E397 Westgate Building University Park PA 16802 cml195@psu.edu (814) 863-9461
Program Website	View (https://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-enterprise-architecture-business-transformation-masters-degree/overview/)

Entomology

Graduate Program Head	Gary W. Felton
Program Code	ENT
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Dual-Title Ph.D. and M.S. in Entomology and Comparative and International Education Dual-Title Ph.D. and M.S. in Entomology and International Agriculture and Development Dual-Title Ph.D. and M.S. in Entomology and Operations Research
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=ENT)

Students in Entomology represent a range of experiences and interests, with varied backgrounds from biology, chemistry, zoology, entomology, meteorology, ecology, and botany programs to name a few. You will find an exceptional faculty that offer an unequalled range of research expertise and breadth within our focus areas. The strength of our research resides in four main program themes:

- Chemical Ecology
- Ecological Applications
- Disease Biology and Ecology
- Pollinator Biology and Ecology

Many opportunities are available for study abroad experiences from which students return with a new perspective that enhances their studies and research. Additional specialization is available to students conducting research with insects in intercollege degree programs in ecology, genetics and plant biology.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

For admission a student should have a strong background in biological sciences. Courses in chemistry through organic, physics, mathematics through calculus, statistics, and computer application are recommended.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The Master of Science degree in Entomology is an intermediate degree leading toward the development of special knowledge in entomology. It provides training for prospective doctoral candidates. A minimum of 30 credits (400 and 500 level) is required, with at least 20 credits earned in residence. At least 18 credits in the 500 and 600 series must be included in the program. A minimum of 12 credits in coursework (400 and 500) must be completed in the major program.

Code	Title	Credits
Required Courses		
ENT 432	Insect Biodiversity and Evolution	4
ENT 518	Insect Natural History	2
ENT 522	Critical Thinking and Professional Development in Entomology	6
ENT 530	Seminar in Insect Science	2
3 credits of 400- to 500-level ENT courses		3
3 credits of statistics (i.e., STAT 501, STAT 502, STAT 541, AG 400, or equivalent)		3
ENT 590	Colloquium	1

Electives

Additional courses may be selected by the student in consultation with his/her graduate committee. 3

Culminating Experience

Code	Title	Credits
ENT 600	Thesis Research	6
Total Credits		30

Each master's student is expected to serve as a teaching assistant for 3 credits (ENT 602); however, these 3 credits cannot be counted towards the minimum credits required for the degree.

Each student must present the results of thesis research at a departmental seminar, and the student may register for 1 credit of ENT 590 that semester. A thesis equivalent to 6 credits (ENT 600) is required. A final oral examination covering the general field of entomology, with emphasis in the student's area of specialization, is required by the department. This is to be administered by the student's committee. A favorable vote of a two-thirds majority is necessary for passing.

Committees for master's degree candidates should be formed during the first semester, and are suggested jointly by the student and adviser, with approval by the Department Head. Masters committees have a minimum of three members. One of these should be from another degree program, particularly if the student plans to minor in that area. Adjunct faculty members cannot constitute a majority of the committee. The student and committee shall meet early in the process to plan the student's program and approve a thesis project. Refer to the Graduate School's Thesis and Dissertation Guide (<http://gradschool.psu.edu/current-students/etd/thesisdissertationguidepdf/>).

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The degree of Doctor of Philosophy signifies high scholastic achievement and demonstrated capability in independent research. Although there is no formal credit requirement at the Ph.D. level, five academic years of full time graduate work beyond the bachelor's degree are normally required. Some of the work may be completed off campus or on a part-time basis, but between admission to the Ph.D. program and completion of the Ph.D. program, the student must spend two academic sessions in residence within a twelve-month period. The program requires all students to take:

Code	Title	Credits
Required Courses		
ENT 432	Insect Biodiversity and Evolution	4
ENT 518	Insect Natural History	2
ENT 522	Critical Thinking and Professional Development in Entomology	6
ENT 530	Seminar in Insect Science	4
3 credits of 400- or 500-level ENT courses		3

Other course requirements are dependent on the student's program of study. Each Ph.D. student is expected to serve as a teaching assistant for 6 credits (ENT 602). The results of the dissertation research must be presented at a departmental seminar. In addition, students must take and pass a comprehensive and final oral examination. Students commencing a doctoral program may have a provisional committee appointed as soon as the adviser is selected. A favorable vote by two-thirds of the qualifying examination committee members is necessary to pass the qualifying examination.

The official Ph.D. committee is approved by the Department Head and is appointed by the Dean of the Graduate School through the office of

Graduate Enrollment Services after the student has passed the qualifying exam. Ph.D. committees for students in the Entomology program include at least three members from the department, at least one member from a related field outside Entomology, and a total of no fewer than four members; five members are recommended. Typically, committee members are chosen in consultation with the adviser. If the student has a formal minor, a representative of the minor field must be on the committee.

The student and committee should meet early in the degree process to plan the student's Ph.D. program and approve a dissertation project. A student may change adviser or committee members without prejudice. The Ph.D. committee guides and monitors the student's progress, administers the comprehensive and final oral examinations, and evaluates the dissertation. Students are not formally admitted to doctoral candidacy until they have passed the comprehensive examination.

A student in the Doctor of Philosophy degree program is required to demonstrate high-level competence in the use of the English language, including reading, writing, and speaking, as part of the language and communication requirements for the Ph.D. Entomology assesses and works to improve competence of both domestic and international students. Assessments to evaluate competency prior to the qualifying exam include pieces of original writing required as part of ENT 522. Oral communication competency is evaluated during the qualifying examination. Students needing assistance are directed to appropriate remedial activities. International students should note that passage of the minimal TOEFL or IELTS requirement does not demonstrate the level of competence expected of a Ph.D. from Penn State.

There is no foreign language requirement for the Ph.D. degree. However, depending on the nature of the dissertation research and with the advice and consent of the Ph.D. committee, competency in a foreign language may be required as a part of the doctoral studies of certain students.

Dual-Titles

Dual-Title M.S. and Ph.D. in Entomology and Comparative and International Education

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Graduate students with research and educational interests in international education may apply to the Entomology/CIED dual-title degree program. The goal of the dual-title degree Entomology and CIED graduate program is to enable graduate students from Entomology to acquire the knowledge and skill of their primary area of specialization in Entomology, while at the same time gaining the perspective and methods of comparative and international education. Graduate dual-title degree program in Entomology and CIED study in this program seeks to prepare students to assume leadership roles in science, science education, outreach, and project management anywhere in the world. Students are required to write research proposals and expected to write grants to support their research activities, reflecting the dual-title degree. As part of their professional development, presentations, publication of research articles, and active participation in professional societies is expected. Emphasis is placed upon the professional development of the student. Students are able to specialize in the research program areas of chemical ecology, disease ecology and biology, pollinator ecology and biology, ecology, genomic, and pest management. Additional specialization is available to students performing research with insects in the inter-college

degree programs in genetics, ecology, and plant biology. At the same time they will acquire a broad perspective about how to apply their research findings in the context of the broader international community. Thus, the dual-title will allow students to master their field of specialization from an international perspective so that they can compare practices and outcomes between countries and regions.

Admission Requirements

For admission to the dual-title degree under this program, a student must first apply and be admitted to the Entomology graduate program. Once accepted into the Entomology program, the student can apply to the Admissions Committee on the Comparative and International Education program. The CIED admissions committee reviews applications and recommends students for admission to the dual-title degree program to the Graduate School. Scores from the Graduate Records Examinations (GRE) are required for admission. In addition, students are to provide a written personal statement indicating the career goals they hope to accomplish by earning a dual-title Entomology/CIED degree. Refer to the Admission Requirements section of the CIED Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/comparative-international-education/>). Doctoral students must be admitted into the dual-title degree program in CIED prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for a dual-title degree, students must satisfy the requirements of the Entomology program in which they are primarily enrolled. In addition, students must complete the degree requirements for the dual-title in CIED, listed on the CIED Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/comparative-international-education/>). Within this framework, final course selection is determined by the student, their CIED adviser, and their Entomology program adviser.

Upon a student's acceptance by the CIED admissions committee, the student will be assigned a CIED academic adviser in consultation with the CIED program chair. As students develop specific scholarly interests, they may request that a different CIED faculty member serve as their adviser. The student and adviser will discuss a program of study that is appropriate for the student's professional objectives and that is in accord with the policies of Graduate Council, the Entomology program, and the CIED program.

Requirements for the Dual-Title M.S.

The master's in Entomology and CIED is a dual-title degree awarded only to students who are admitted to the Entomology master's program and admitted to the dual-title degree in CIED. Some courses may satisfy both the graduate primary program requirements and those of the CIED program. Final course selection is determined by the students in consultation with their CIED advisers and their major program advisers. Students and advisers should maintain the CIED Master's Degree Plan of Study, which must be submitted to the CIED program office two months before the student files the "Intent to Graduate" via LionPATH.

Dual-title M.S. students must write a master's thesis on a topic that reflects both the graduate program in Entomology and the dual-title offering in Comparative and International Education. The thesis committee for the dual-title M.S. degree will consist of two Graduate Faculty members from Entomology and one graduate faculty member from CIED.

Dual-title master's degree students in Entomology and CIED will also be required to pass a final oral examination covering the general field of Entomology and CIED, with emphasis on the student's area of

specialization. The oral exam (thesis defense) is to be administered by the student's thesis committee. A favorable vote of a two-thirds majority is necessary for passing.

Requirements for the Dual-Title Ph.D.

The doctoral degree in Entomology and CIED is a dual-title degree awarded only to students who are admitted to the Entomology doctoral program and admitted to the dual-title degree in CIED. To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Entomology, listed in the Degree Requirements section. In addition, students must complete the degree requirements for the dual-title in CIED, listed on the CIED Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/comparative-international-education/>).

Particular courses may satisfy both the Entomology Department requirements and those in the Comparative and International Education program. Final course selection is determined by the student in consultation with their CIED advisers and their major program advisers. Students who already hold a master's degree from another institution may petition to have equivalent course credits accepted.

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Entomology and must include at least one Graduate Faculty member from the CIED program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Entomology and CIED. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of an Entomology and CIED dual-title Ph.D. student must include at least one member of the CIED Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in CIED, the member of the committee representing CIED must be appointed as co-chair. The CIED representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Entomology and CIED. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title M.S. and Ph.D. in Entomology and International Agriculture and Development

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Graduate students with research and educational interests in international agriculture and development may apply to the Entomology/INTAD Dual-Title Degree Program. The goal of the dual-title degree

Entomology and INTAD graduate program is to enable graduate students from Entomology to acquire the knowledge and skills of their primary area of specialization in Entomology, while at the same time gaining the perspective and methods needed for work in the international agriculture. Graduate study in this program seeks to prepare students to assume leadership roles in science, science education, outreach, and project management anywhere in the world. Students are required to write research proposals and expected to write grants to support their research activities, reflecting the dual-title degree. As part of their professional development presentations, publication of research articles and active participation in professional societies is expected. Emphasis is placed upon the professional development of the student. Students are able to specialize in the research program areas of chemical ecology, disease ecology and biology, pollinator ecology and biology, ecology, genomics, and pest management. Additional specialization is available to students performing research with insects in the inter-college degree programs in genetics, ecology, and plant biology. At the same time they will acquire a broad perspective about how to apply their research findings in the context of the broader international community. Thus, the dual-title will allow students to master their field of specialization from an international perspective so that they can compare practices and outcomes between countries and regions.

Admission Requirements

For admission to the dual-title doctoral degree under this program, a student must first apply and be admitted to the Entomology graduate program. Once accepted into the Entomology program, the student can then submit an application to the INTAD Academic Program Committee for the dual-title degree program. The application consists of a written personal statement indicating the career goals that a student hopes to accomplish by earning a dual-title ENT/INTAD degree. For admission a student should have a strong background in biological sciences. Courses in chemistry through organic, physics, mathematics through calculus, statistics, and computer application are recommended. Refer to the Admission Requirements section of the INTAD Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/international-agriculture-development/>). Doctoral students must be admitted into the dual-title degree program in INTAD prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for a dual-title degree, students must satisfy the requirements of the Entomology program in which they are primarily enrolled. In addition, students must complete the degree requirements for the dual-title in INTAD, listed on the INTAD Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/international-agriculture-development/>).

Requirements for the Dual-Title M.S.

The dual-title master's in Entomology and INTAD is awarded only to students who are admitted to the Entomology master's program and admitted to the dual-title degree in INTAD. Some courses may satisfy both the graduate primary program requirements and those of the INTAD program. Final course selection is determined by the students in consultation with their INTAD advisors and their Entomology program advisors. Permission from a student's academic adviser, in consultation with the program chair, is required to substitute a 400-level course for a 500-level course; however, the requirement for 18 credits at the 500 and 600 level combined must still be met, in total, across both the major and the dual-title courses of study. Students and advisors should maintain the INTAD Master's Degree Plan of Study, which must be submitted to the INTAD program office two months before the student files the "Intent to Graduate" via LionPATH.

Students in the program must write a master's thesis on a topic that reflects both the graduate program in entomology and the dual-title offering in INTAD. Thesis research credits (SUBJ 600) must be taken in the major program. All members of the student's committee for the dual-title master's degree will be members of the Graduate Faculty. The committee must include at least one Graduate Faculty member from INTAD. A Degree Committee form should be filed upon selection of the committee members and should be approved by the INTAD Academic Program Committee Co-chair.

Candidates for the dual-title master's degree in Entomology and INTAD will also be required to pass a final oral examination covering the general field of entomology and INTAD, with emphasis on the student's area of specialization. The oral exam is to be administered by the student's thesis committee. A favorable vote of a two-thirds majority is necessary for passing.

Requirements for the Dual-Title Ph.D.

The doctoral degree in Entomology and INTAD is a dual-title degree awarded only to students who are admitted to the Entomology doctoral program and admitted to the dual-title degree in INTAD.

Permission from a student's academic adviser, in consultation with the program chair, is required to substitute a 400-level course for a 500-level course; however, the requirement for 18 INTAD credits at the 500 or 800 level must still be met, in total, across both the major and the dual-title courses of study. Particular courses may satisfy both the Entomology Department requirements and those in the INTAD program. Final course selection is determined by the student in consultation with their INTAD advisers and their Entomology program advisers. Students who already hold a master's degree from another institution may petition to have equivalent course credits accepted.

Graduates of the dual-title INTAD master's degree program who wish to pursue an INTAD doctoral degree must re-apply to the INTAD program for admission. INTAD master's degree credits may be carried over to the doctoral program. Six additional INTAD credits will be required. INTAD master's degree graduates who pursue an INTAD Ph.D. are required to take the INTAD 820 International Agricultural Development Seminar a second time.

Qualifying Examination

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Entomology and must include at least one Graduate Faculty member from the INTAD program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Entomology and INTAD. Qualifying examination procedures will be based on the procedures of the major department and will have an international dimension. Although not encouraged, the dual-title degree student may require an additional semester or more to fulfill requirements for the dual-title degree program. Therefore, under exceptional circumstances, the qualifying exam may be delayed at the discretion of the student's adviser in consultation with the INTAD program coordinators.

Ph.D. Committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of an Entomology and INTAD dual-title Ph.D. student must include at least one member of the INTAD Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not

also a member of the Graduate Faculty in INTAD, the member of the committee representing INTAD must be appointed as co-chair.

Comprehensive Exam

At the end of the course work, students in the dual-title doctoral degree program in Entomology and INTAD will be required to pass an oral comprehensive examination based on their thesis proposal and area of specialization in entomology, while reflecting their dual-title curriculum. A separate comprehensive examination is not required by the INTAD program, but international agriculture must be one of the key areas of the exam and the INTAD representative on the student's Ph.D. committee must have input into the development of and participation in the evaluation of the comprehensive examination.

Dissertation and Dissertation Defense

Ph.D. students enrolled in the dual-title degree program are required to write and orally defend a dissertation on a topic that reflects their original research and education in both Entomology and International Agriculture and Development. The dissertation should contribute to the body of knowledge in international agriculture. A public oral presentation of the dissertation is required. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title M.S. and Ph.D. in Entomology and Operations Research

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Graduate students with research and educational interests in operations research may apply to the Entomology/OR Dual-Title Degree Program. The goal of the dual-title degree Entomology and OR graduate program is to enable graduate students from Entomology to acquire the knowledge and skill of their primary area of specialization in Entomology, while at the same time attain and be identified with the tools, techniques, and methodology of operations research. Operations research is the analysis—usually involving mathematical treatment—of a process, problem, or operation to determine its purpose and effectiveness and to gain maximum efficiency. Graduate Dual-Title degree program in Entomology and OR study in this program seeks to prepare students to assume leadership roles in science, science education, outreach, and project management anywhere in the world. Students are required to write research proposals and expected to write grants to support their research activities, reflecting the dual-title degree. As part of their professional development, presentations, publication of research articles, and active participation in professional societies is expected. Emphasis is placed upon the professional development of the student. Students are able to specialize in the research program areas of chemical ecology, disease ecology and biology, pollinator ecology and biology, ecology, genomics, and pest management. Additional specialization is available to students performing research with insects in the inter-college degree programs in genetics, ecology, and plant biology. At the same time they will acquire a broad perspective about how to apply their research findings in the context of operations research. Thus, the dual-title will allow students to master their field of specialization from an operations research perspective.

Admission Requirements

For admission to the dual-title degree under this program, a student must first apply and be admitted to the Entomology graduate program. Once accepted into the Entomology program, the student can apply to the Admissions Committee of the Operations Research program. The OR

admissions committee reviews applications and recommends students for admission to the dual-title degree program to the Graduate School. Scores from the Graduate Records Examinations (GRE) are required for admission. Refer to the Admission Requirements section of the OR Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>). Doctoral students must be admitted into the dual-title degree program in OR prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for a dual-title degree, students must satisfy the requirements of the Entomology program in which they are primarily enrolled. In addition, students must complete the degree requirements for the dual-title in OR, listed on the OR Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>). Within this framework, final course selection is determined by the student, their OR adviser, and their Entomology program adviser.

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Entomology and must include at least one Graduate Faculty member from the OR program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Entomology and OR. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of an Entomology and OR dual-title Ph.D. student must include at least one member of the OR Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in OR, the member of the committee representing OR must be appointed as co-chair. The OR representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Entomology and OR. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)

- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Entomology (ENT) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/ent/>)

Learning Outcomes

Master of science (M.S.)

1. Know: Graduates will demonstrate in depth knowledge of the core theories and methods as well as within one or more sub-specialties in the field of entomology. The core demonstration will include the application of insect ecology, physiology, systematics, and natural history, to problems in agriculture, chemical ecology, pollinator ecology, biotechnology, and integrated pest management.
2. Create: Graduates will be able to creatively synthesize theory and current literature to generate new ideas or hypotheses in the entomological sciences, devise critical tests of hypotheses, and/or develop unique solutions to entomological problems.
3. Apply: Graduates will be able to carry out independent and original research studies that address current problems in the field of entomology.
4. Critical thinking: Graduates will be able to critically analyze work by others in their field of specialty.
5. Communicate: Graduates will be able to convey ideas or arguments in clear, concise, well-organized papers and proposals as well as in formal, oral presentations.
6. Professional practice: Graduates will demonstrate the ability to collaborate in a collegial and ethical manner with other professionals within their field or with diverse scientific backgrounds. Graduates

will demonstrate the PSU core values of Integrity, Respect, Responsibility, Discovery, Excellence, and Community.

Doctor of Philosophy (Ph.D.)

1. Know: Graduates will demonstrate in depth knowledge of the core theories and methods as well as within one or more sub-specialties in the field of entomology. The core demonstration will include the application of insect ecology, physiology, systematics, and natural history, to problems in agriculture, chemical ecology, pollinator ecology, biotechnology, and integrated pest management.
2. Create: Graduates will be able to creatively synthesize theory and current literature to generate new ideas or hypotheses in the entomological sciences, devise critical tests of hypotheses, and/or develop unique solutions to entomological problems.
3. Apply: Graduates will be able to carry out independent and original research studies that address current problems in the field of entomology.
4. Critical thinking: Graduates will be able to critically analyze work by others in their field of specialty.
5. Communicate: Graduates will be able to convey ideas or arguments in clear, concise, well-organized papers and proposals as well as in formal, oral presentations.
6. Professional practice: Graduates will demonstrate the ability to collaborate in a collegial and ethical manner with other professionals within their field or with diverse scientific backgrounds. Graduates will demonstrate the PSU core values of Integrity, Respect, Responsibility, Discovery, Excellence, and Community.

Contact

Campus	University Park
Graduate Program Head	Gary Felton
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	John Tooker
Program Contact	Susan Bass 501F ASI Building University Park PA 16802 sgb13@psu.edu (814) 865-3077
Program Website	View (http://ento.psu.edu/graduateprograms/)

Environmental Engineering

Graduate Program Head	Farshad Rajabipour
Program Code	ENV_E
Campus(es)	University Park (Ph.D., M.S., M.Eng.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Master of Engineering (M.Eng.) Dual-Title Ph.D. in Environmental Engineering and Biogeochemistry
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=ENV_E)

This specialty prepares students for careers in:

- the design of treatment facilities,
- environmental monitoring,
- process development for water quality control,
- industrial waste treatment,
- management of hazardous and toxic substances,
- monitoring and management of environmental quality,
- air pollution control,
- and water resource systems.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Applicants should possess a baccalaureate degree from a regionally accredited institution. Students in engineering, physical sciences, or mathematics with a 3.00 grade-point average (on a 4.00 scale) may be considered for admission. Exceptions to the minimum 3.00 grade-point average may be made for students with special backgrounds, abilities, and interests. Students without a baccalaureate degree in engineering would be admitted on a provisional basis (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/provisional-admission/>) pending successful completion of entrance requirements (completed concurrently with degree requirements).

All applicants must submit official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>), a statement of objectives, and three references for letters of recommendation when applying to the program. Submission of GRE scores is recommended but not required. For the M.Eng. degree, the recommendation for GRE scores is waived for students who have graduated with a degree from the College of Engineering at The Pennsylvania State University with a cumulative grade-point average of greater than 3.30.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Application Deadlines

M.Eng.: Complete applications including required supplementary materials (e.g., official transcripts, reference letters) should be submitted by June 1st of the calendar year for admission in Fall semester. International students are strongly encouraged to submit complete applications early to allow sufficient time for visa processing.

M.S. and Ph.D.: Complete applications including required supplementary materials (e.g., official transcripts, reference letters) should be submitted by September 15th for admission in Spring semester and by December 15th for admission in Fall semester. International students are strongly encouraged to submit complete applications early to allow sufficient time for visa processing.

Degree Requirements

Master of Engineering (M.Eng.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The M.Eng. degree is a non-thesis professional master's degree. The program provides training for advanced professional practice. A minimum of 31 credits (400, 500, and 800 level) of course work are required. At least 18 credits must be earned in graduate courses (500 level). At least 12 credits must be earned in courses with the CE prefix. At least 20 credits must be earned at an established graduate campus of the University. All students are required to take CE 835 to fulfill the requirement for a culminating experience. Specific core courses are also required. All students are required to take the 1-credit CE 590 and complete all requirements for Scholarship and Research Integrity (SARI) training. The M.Eng. degree is designed as a two-semester master's degree program and students are required to start their degree in the Fall semester. The preferred plan of study is as follows:

- Fall semester: Fifteen credits of course work plus one credit of CE 590
- Spring semester: Fifteen credits of course work, including CE 835

Continuous registration is required for all M.S. and Ph.D. graduate students until the thesis (M.S.) or dissertation (Ph.D.) has been approved or course requirements have been satisfied (M.Eng.).

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The M.S. degree program is strongly oriented toward research. A thesis is required, and at least 6 credits of thesis research (CE 600 or CE 610) must be included in the student's academic course plan. A minimum of 31 credits (400, 500, 600, and 800 level) are required, of which 20 must be earned at an established graduate campus of the University. A minimum of 24 credits of course work are required. A minimum of 12 credits of course work (400 and 500 level) must be completed in the major (courses prefixed CE). At least 18 credits in the 500 and 600 levels, combined, must be included in the program. Specific core courses are also required. All students are required to take the 1-credit CE 590 and complete all requirements for Scholarship and Research Integrity (SARI) training. Students are not permitted to count audited credits toward the minimum credits required for the degree.

Continuous registration is required for all M.S. and Ph.D. graduate students until the thesis (M.S.) or dissertation (Ph.D.) has been approved or course requirements have been satisfied (M.Eng.).

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

For the Ph.D. degree, a minimum of 21 credits of course work (400, 500, 600, and 800) is required beyond the M.S. degree, or 15 credits beyond the M.S. in Environmental Engineering from Penn State. Specific core courses are also required. All students are required to take the 1-credit CE 590 and complete all requirements for Scholarship and Research Integrity (SARI) training. Students are not permitted to count audited credits toward the minimum credits required for the degree. A candidate

for the Ph.D. degree must pass the English proficiency and qualifying examinations, prepare and defend the dissertation proposal as part of the oral comprehensive examination, and pass the final oral examination (dissertation defense). Prior to completion of the Ph.D. program, the student must spend at least two consecutive semesters as a registered full-time student.

Continuous registration is required for all M.S. and Ph.D. graduate students until the thesis (M.S.) or dissertation (Ph.D.) has been approved or course requirements have been satisfied (M.Eng.).

Dual-Titles

Dual-title Ph.D. in Environmental Engineering and Biogeochemistry

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Graduate students with research and educational interests in biogeochemistry may apply to the Biogeochemistry dual-title degree program. Students must apply and be admitted to the graduate program in Environmental Engineering and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Biogeochemistry dual-title program. Refer to the Admission Requirements section of the Biogeochemistry Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/biogeochemistry/>). Doctoral students must be admitted into the dual-title degree program in Biogeochemistry prior to taking the qualifying examination in their primary graduate program.

Students in the Biogeochemistry Dual Title program are required to have two advisers from separate disciplines:

1. one individual serving as a primary adviser in their major degree program
2. and a secondary adviser in an area within a field covered by the dual-title program and a member of the Biogeochemistry faculty.

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Environmental Engineering, listed in the Degree Requirements section. In addition, students must complete the degree requirements for the dual-title in Biogeochemistry, listed on the Biogeochemistry Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/biogeochemistry/>).

All students must pass a qualifying examination that includes an assessment of their potential in the field of biogeochemistry. A single qualifying examination that includes biogeochemistry will be administered for admission into the student's Ph.D. program, as well as the biogeochemistry dual-title. The structure and timing of this exam will be determined jointly by the dual-title and major program. The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Environmental Engineering and must include at least one Graduate Faculty member from the Biogeochemistry program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of an Environmental Engineering and Biogeochemistry dual-title Ph.D. student must include at least one member of the Biogeochemistry Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Biogeochemistry, the member of the committee representing Biogeochemistry must be appointed as co-chair. The Biogeochemistry representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Environmental Engineering and Biogeochemistry. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

International applicants who wish to be considered for a teaching assistantship must present an acceptable score (250-300 or 55-60) on the Test of Spoken English (TSE). The TSE can be taken in many countries, or at Penn State after arrival. The Department offers a number of graduate fellowships.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Civil Engineering (CE) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/ce/>)

Learning Outcomes

Master of Engineering (m.Eng.)

1. **KNOW:** Graduates will be able to demonstrate understanding of advanced core principles and methods from selected sub-fields of Environmental Engineering at a depth consistent with their course of study.
2. **APPLY/CREATE:** Graduates will be able to apply their knowledge of selected sub-fields of Environmental Engineering to design and evaluate engineering solutions.
3. **THINK:** Graduates will be able to analyze and synthesize knowledge within the field of Environmental Engineering to address a complex problem of practical relevance.
4. **COMMUNICATE:** Graduates will be able to demonstrate proficiency in oral and written communication appropriate to their discipline.
5. **PROFESSIONAL PRACTICE:** Graduates will be able to demonstrate an understanding of, and a commitment to, academic integrity and the standards for professional practice within Environmental Engineering.

Master of Science (M.S.)

1. **KNOW:** Graduates will be able to demonstrate understanding of advanced core principles and methods from selected sub-fields of Environmental Engineering at a depth consistent with their course of study.
2. **APPLY/CREATE:** Graduates will be able to apply their knowledge of selected sub-fields of Environmental Engineering to design and evaluate engineering solutions.
3. **THINK:** Graduates will be able to analyze and synthesize knowledge within the field of Environmental Engineering to extend existing knowledge through a research-based culminating experience.
4. **COMMUNICATE:** Graduates will be able to demonstrate proficiency in oral and written communication appropriate to their discipline.
5. **PROFESSIONAL PRACTICE:** Graduates will be able to demonstrate an understanding of, and a commitment to, the standards for scholarship and research integrity within Environmental Engineering.

Doctor of Philosophy (Ph.D.)

1. **KNOW:** Graduates will be able to demonstrate an understanding of advanced core principles and methods as well as modern research findings from selected sub-fields of Environmental Engineering at a depth appropriate for conceptualizing and conducting independent research.
2. **APPLY/CREATE:** Graduates will be able to apply their knowledge of selected sub-fields of Environmental Engineering in formulating and executing a research plan.
3. **THINK:** Graduates will be able to demonstrate the ability to analyze and synthesize appropriate literature, to critically review their work in

the context of the literature, and to formulate and defend conclusions based on their research that represent new scholarly contributions.

4. **COMMUNICATE:** Graduates will be able to demonstrate high levels of proficiency in oral and written communication.
5. **PROFESSIONAL PRACTICE:** Graduates will be able to demonstrate an understanding of, and a commitment to, the standards for scholarship and research integrity.

Contact

Campus	University Park
Graduate Program Head	Farshad Rajabipour
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Tong Qiu
Program Contact	Tong Qiu Civil Environmental Engineering 216 Sackett Bldg. University Park PA 16802 tuq1@psu.edu (814) 863-7305
Program Website	View (http://www.engr.psu.edu/ce/)

Epidemiology

Graduate Program Head	Cheryl Thompson
Program Code	EPID
Campus(es)	Hershey (Ph.D.)
Degrees Conferred	Doctor of Philosophy (Ph.D.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=EPID)

Epidemiology is the discipline for the study of the distribution and determinants of health-related states or events (including diseases) in specified human populations, and the application of this study to the prevention and control of health problems. Epidemiology is the primary source of the knowledge that underlies public health policy and practice. As such, well-trained epidemiologists develop and evaluate hypotheses about the effects of various factors (risk factors) on human health and develop the knowledge basis for disease prevention and control programs.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Applicants must complete prior to admission:

1. An M.S. or M.P.H. degree with a focus on epidemiology or biostatistics.
2. A two-semester graduate level course in Epidemiology, comparable to PHS 550 and PHS 551.
3. A two-semester graduate level course in Biostatistics, comparable to PHS 520 and PHS 521.

Prospective applicants must demonstrate:

1. Completion of an undergraduate bachelor degree program at an accredited U.S. college or university, or its equivalent in another country, with a GPA of 3.0 or higher. Official transcripts from all post-secondary institutions attended are required. (<http://gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>)
2. Completion of the Graduate School application, which includes three (3) letters of recommendation and a Curriculum Vita or resume.
3. Payment of the nonrefundable application fee.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Students enrolled in the Epidemiology Ph.D. program must successfully complete a minimum of 28 credits, including:

Code	Title	Credits
Required Courses		
PHS 554	Statistical Methods in Public Health I	3
PHS 555	Statistical Methods for Public Health II	3
PHS 510	Grant Writing for Clinical Research	3
PHS 500	Research Ethics for Clinical Investigators	1
A minimum of 12 credits in Substantive Epidemiology courses ¹		12
A minimum of 6 credits in either Substantive Epidemiology courses or other Biostatistics courses ¹		6
Total Credits		28

¹ The list of courses that will fulfill these requirements is maintained by the graduate program office.

Additionally, Epidemiology Ph.D. students are required to fulfill the following requirements:

- Epidemiology and biostatistics seminar series: Students are required to attend. Each student is required to present at least one seminar each year.
- Pass a qualifying examination which may be given after at least 18 credits have been earned in graduate courses beyond the baccalaureate, and must be taken within three semesters (excluding summer sessions) of entry into the doctoral program.
- Pass a comprehensive examination which will be a defense of the dissertation research proposal, administered by the entire Ph.D. committee after the student has substantially completed all course work.
- To earn the Ph.D. degree, doctoral candidates must write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.
- Pass a final oral examination (the dissertation defense).

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Epidemiology (EPID) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/epid/>)

Contact

Campus	Hershey Med Ctr
Graduate Program Head	Cheryl Thompson
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Duanping Liao
Program Contact	Justine Shultz PO Box 855 90 Hope Drive Hershey PA 17033-0855 jes5437@psu.edu (717) 531-0003 Ext. 287460
Program Website	View (https://med.psu.edu/epidemiology-phd/)

Finance (Great Valley)

Graduate Program Head	Zugang Liu
Program Code	FINAN
Campus(es)	Great Valley (M.Fin.) World Campus (M.Fin.)
Degrees Conferred	Master of Finance (M.Fin.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=FINAN)

The Master of Finance (M.Fin.) program offered at Penn State Great Valley is designed for intensive and focused study in finance. The program is fully accredited by AACSB International. Classes are offered in a schedule convenient for working professionals who have demanding time commitments. Students can choose from the base program focusing on Financial Analysis or the Financial Data Analytics option.

The program provides an advanced and specialized graduate education in finance for individuals with career interests as finance professionals in financial management, or investment management. The curriculum reflects a balanced combination of advanced financial theory and practical business applications. Major emerging concepts and practices in the finance field are introduced and discussed throughout the program. The base program focusing on Financial Analysis is designed to help graduates to become proficient in technical and analytical skills in finance and to develop expertise in financial problem solving and financial decision-making preparing them to advance their finance careers in organizations such as investment and commercial banking firms, mutual funds, other financial firms, non-financial businesses, consulting firms, government agencies and non-profit organizations. In addition, students will find a substantial number of courses in the M.Fin. program to be helpful in preparing for tests required for various professional certifications in finance, such as the Chartered Financial Analyst (CFA). This program is offered as a resident program at the School of Graduate Professional Studies (Great Valley) and through the Penn State World Campus.

The Financial Data Analytics option is an interdisciplinary program designed to prepare graduates with the knowledge and skills to analyze financial data and extract valuable insights to facilitate financial decisions. The option is offered as a resident program at the School of Graduate Professional Studies (Great Valley).

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Applicants should:

1. Have a 3.0 or better (on a 4.0 scale) junior/senior grade-point average.

2. Submit a completed online application.
3. Submit a GMAT or GRE score. Applicants can request a waiver if they meet one of the following criteria:
 - An undergraduate junior/senior GPA of a least 3.0 on a 4.0 scale at a regionally-accredited university with AACSB, EQUIS, or AMBA accredited business programs or an undergraduate junior/senior GPA of a least 3.3 on a 4.0 scale from a regionally-accredited university. without AACSB, EQUIS, or AMBA accredited business programs AND demonstrated effective communication and quantitative skills based on course work.
 - An advanced degree (master's or higher) from a regionally-accredited university with AACSB, EQUIS, or AMBA accredited business programs.
 - Membership in Beta Gamma Sigma, the business honorary society recognized by AACSB.
 - One or more professional certifications including a C.F.A., C.P.A., F.R.M. and/or C.M.A., or doctoral degree (e.g. Ph.D., M.D., or J.D.).
4. Submit a statement of intent or career path objective (one page).
5. Submit one confidential evaluation form letters.
6. Submit official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>). International applicants must submit official university records (transcripts/marksheets and diploma if date conferred does not appear on transcripts/marksheets), with attested English translations if the record is not in English. Notarized copies are not sufficient.
7. Submit a current resume.
8. Submit a visa application document if they are in the U.S. on a student or work visa.

Admission decisions are based on the quality of the applicant's credentials in relation to those of other applicants who meet the requirements for admission outlined above.

Application Filing Dates: Applications to the Penn State Great Valley's Master of Finance program are reviewed on a rolling basis. New students are admitted and begin their studies in early January and late August.

Degree Requirements

Master of Finance (M.Fin.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Thirty-three (33) credits are required to complete the M.Fin. degree. The course work includes:

- six required core courses (18 credit hours) which provide a body of knowledge in finance;
- four prescribed courses (12 credit hours) designed to help students develop additional expertise in financial analysis or financial data analytics;
- and a capstone course (3 credit hours) which provides a culminating experience for students.

Code	Title	Credits
Required Courses		
BA 831	Foundations in Finance	3

ACCTG 512	Financial Accounting Theory and Reporting Problems	3
BUSAD 525	Quantitative Methods in Finance	3
BUSAD 826	Current Issues in Corporate Finance	3
FIN 808	Analysis of Financial Markets	3
FIN 813	Speculative Markets	3
Electives or Option		
Select 4 electives or complete the Financial Data Analytics Option required courses. ¹		12
Culminating Experience		
BUSAD 585	Research in Security Valuation ²	3
	or BUSAD 888 Applications of Financial Data Analytics	
Total Credits		33

- 1 The electives allow students in the base program to choose from a menu of courses maintained by the graduate program office, or to select prescribed courses that meet the requirements for the option.
- 2 All students will complete their program of study with a capstone course corresponding to the base program (BUSAD 585) or the option (BUSAD 888).

For the base program, students may enroll in the Master of Finance program at the Great Valley Campus, taking courses in a face-to-face and blended format. Alternatively, students may enroll in the online Master of Finance program offered through the Penn State World Campus. A one-week residency at Great Valley is required as part of the online program.

Base Program

(Offered at Penn State Great Valley and through World Campus)

The program provides an advanced and specialized graduate education in finance for individuals with career interests as finance professionals in financial management, or investment management. The curriculum reflects a balanced combination of advanced financial theory and practical business applications. Major emerging concepts and practices in the finance field are introduced and discussed throughout the program. The program is designed to help graduates to become proficient in technical and analytical skills in finance and to develop expertise in financial problem solving and financial decision-making preparing them to advance their finance careers in organizations such as investment and commercial banking firms, mutual funds, other financial firms, non-financial businesses, consulting firms, government agencies and non-profit organizations. In addition, students will find a substantial number of courses in the M.Fin. program to be helpful in preparing for tests required for various professional certifications in finance, such as the Chartered Financial Analyst (CFA).

Base Program Electives

Students are required to take 4 courses (12 credits) from a list of electives maintained by the graduate program office. The electives allow students to focus in a selected field of finance such as corporate financial management or investment management. Students may also choose one non-finance course (3 credits) with the approval of the adviser.

Base Program Capstone Course

BUSAD 585 Research in Security Valuation (3 cr.)

Financial Data Analytics Option

(offered at Penn State Great Valley)

This option prepares graduates to learn necessary knowledge and skills to analyze financial data to extract valuable insights in order to facilitate financial decisions. The courses in this option focus on how statistical methods and data mining techniques can be used to analyze real financial data.

Students are required to take 4 courses (12 credits) as indicated below.

Code	Title	Credits
Required Courses		
BUSAD 829	Data Analysis in Finance	3
DAAN 871	Data Visualization	3
IE 575	Foundations of Predictive Analytics	3
SWENG 545	Data Mining	3
Total Credits		12

Financial Data Analytics Option Capstone Course

BUSAD 888 Applications of Financial Data Analytics (3 cr.)

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Refer to the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students in this program are not eligible for graduate assistantships.

Financial aid for students in on-campus programs is in the form of student loans and a limited number of small scholarships, as described on the Penn State Great Valley website (<https://greatvalley.psu.edu/tuition-and-financial-aid/>).

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by

graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Finance (FIN) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/fin/>)

Learning Outcomes

- Learning Goal 1: The students will demonstrate enhanced analytical and critical thinking skills. They will be able to:
 - Apply quantitative and analytical knowledge to financial analysis
 - Identify financial risk exposure and manage financial risks with appropriate financial derivative instruments
- Learning Goal 2: The students will understand the impact of global influences on financial decision-making. They will be able to:
 - Demonstrate a knowledge of global financial and foreign exchange markets, and their impact on multinational enterprises
- Learning Goal 3: The students will be effective financial decision makers. They will be able to:
 - Recognize and resolve ethical issues in financial decision making
- Learning Goal 4: The students will be effective communicators in finance. They will be able to:
 - Make an effective presentation of analytical results
 - Prepare a written report on financial issues

Contact

Campus	Great Valley
Graduate Program Head	Zugang Liu
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Qiang Qiang
Program Contact	Teri Shaw Penn State Great Valley 30 E. Swedesford Road Malvern PA 19355 tks5856@psu.edu (610) 648-3250
Program Website	View (http://greatvalley.psu.edu/academics/masters-degrees/finance/)

Campus	World Campus
Graduate Program Head	Zugang Liu
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Qiang Qiang
Program Contact	Teri Shaw 30 E. Swedesford Rd Malvern PA 19355 tks5856@psu.edu (610) 648-3250
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/finance-masters/overview/)

Finance (Smeal)

Graduate Program Head	Kimberly Cornaggia
Program Code	FIN
Campus(es)	University Park (M.Fin.)
Degrees Conferred	Master of Finance (M.Fin.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=FIN)

The Master of Finance in Finance program prepares graduates to stand out in a competitive job market by studying at a highly reputed business school with some of the world's leading academic thinkers in finance and industry experts. This program provides students with the analytical skills grounded in finance and economics needed to successfully engage as strategic managers. Students will gain the skills needed to succeed in today's dynamic work environments, gain a firm understanding of issues and problems facing management, develop an understanding and appreciation for leading edge research in finance, and be prepared to become a successful leader. World-class professors who are specialists in finance and economics will teach in the program. A solid foundation in finance, decision analysis, project management, accounting, valuation, market analysis, econometrics, and investment analysis will make the target audience more attractive to hiring managers and enable graduates to advance more rapidly into management and leadership positions.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Educational Background

Applicants must:

- Submit a completed online Graduate School application for admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>), including nonrefundable application fee, a Statement of Purpose, resume, and two letters of recommendation.
- Submit official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>).

GMAT and/or GRE scores will not be required for admission. Accordingly, these scores will not be accepted.

Students who do not have foundational backgrounds in accounting or statistics may be required to take MBADM 811 and/or MBADM 813 (or equivalent course work) prior to entering the program. The program faculty director will assess the background of each applicant.

Language of Instruction

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Core Application Packet

- Completed official online Graduate School application for admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) and payment of nonrefundable application fee.
- Statement of Purpose: a 600 word essay articulating career and educational goals that demonstrate strong written communication skills.
- Résumé.
- Two letters of recommendation that attest to readiness for graduate study.
- Official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>).
- Visa Application (International Candidates).
- Official English Language Proficiency Exam Scores (International Candidates).

Degree Requirements

Master of Finance (M.Fin.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The number of total credits required for the MFIN program is 31 credits at the 400, 500, or 800 level, with at least 18 credits at the 500 or 800 level, and at least 6 credits at the 500 level.

Code	Title	Credits
Required Courses		
BA 512	Quantitative Analysis for Managerial Decision Making	2
BA 545	Business, Government and International Economics	2
BA 817	Communication Skills for Management	2
BA 821	Foundation in Managerial Accounting	2
BA 831	Foundations in Finance	2
FIN 550	Financial Analysis and Valuation	2
FIN 577	Financial Engineering and Corporate Strategy	2
FIN 855	Global Finance	2
FIN 871	Strategic Financial Management	2
FIN 875	Fixed Income Markets	2
FIN 881	Fundamentals of Financial Markets	2
FIN 883	Modern Portfolio Management: Theory and Practice	2
REST 575	Quantitative Analysis for Real Estate	3
RM 875	Risk Management and Compliance	2
Culminating Experience		
FIN 880	Corporate Finance Analytical Research Projects (Capstone Course)	2
Total Credits		31

The MFIN program culminates with the capstone course, FIN 880 Corporate Finance Analytical Research Projects. FIN 880 combines multidisciplinary critical analysis and problem solving of strategy in the context of a challenging business environment. The capstone course

integrates all of the essential concepts involved in financial decision making cultivated throughout the program.

The aim of the capstone is to assess students' ability to synthesize and integrate the skills they have developed throughout their course work. This course is structured to support student success in fulfilling program goals and requirements. The projects students tackle will mirror what they'll encounter on the job as a significant member of the planning strategic management team. The course integrates topics and methodologies analyzed throughout the program, leading students to understand that strategic analysis, and ultimately, the firm's ability to enhance shareholder value, is a holistic and multifaceted analytical process.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Refer to the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students in this program are not eligible for graduate assistantships.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Business Administration (BA) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/ba/>)

Finance (FIN) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/fin/>)

Learning Outcomes

The Master of Finance in Finance Program Learning Goals and Objectives include:

1. Broad Core of Finance Knowledge: (Know) - MFIN graduates will master a broad core of financial and economic knowledge and be able to apply and integrate this knowledge to business situations as managers and strategic partners in industries requiring interdisciplinary skills and global perspectives.

Primary Learning Objectives:

- MFIN graduates will demonstrate advanced competency in the underlying concepts, theory, and tools taught in core finance and economics programs.
- MFIN graduates will be prepared to synthesize their knowledge of finance, economics and markets to identify, analyze, and recommend solutions to complex strategic problems and projects requiring interdisciplinary and global perspectives.

2. Analytical and Critical Thinking Skills: (Apply/Create) - MFIN graduates will acquire the analytical and critical thinking skills needed to identify, analyze, and evaluate alternative solutions to problems and projects facing today's managers and strategic planners.

Primary Learning Objectives:

- MFIN graduates will be able to analyze and properly articulate and defend their examinations and recommended and create solutions to multiple audiences from business, government, and the community.
- MFIN graduates will be able to integrate findings and analyses from contemporary academic and practitioner research to projects and problems and projects confronting American and Multi-National firms.

3. Interpersonal Skills: (Communicate) - MFIN graduates will develop the interpersonal skills needed to synthesize and evaluate complex situations that impress hiring managers and become effective leaders.

Primary Learning Objectives:

- MFIN graduates will demonstrate skilled leadership, team building, interpersonal influence, and the management of change.
- MFIN graduates will be able to integrate their broad core of finance knowledge, analytical and critical thinking skills, and interpersonal influence to effectively communicate and work successfully with others in work settings involving cultural and demographic diversity.
- MFIN graduates will become natural team leaders with the ability to diagnose and limit the phenomenon of "group think" that often plagues underperforming corporations. Graduates will be able to evaluate, prioritize and recommend ways to draw out the high potential from their team members, leveraging the team's ability to analyze problems from many points of reference.

4. Inter and Intra Discipline Analysis and Critical Thinking: (Think) - MFIN graduates will demonstrate analytical and critical thinking processes across a broad range of projects and corporate situations.

Primary Learning Objectives:

- MFIN graduates will exhibit the skills needed to arrange and classify complex and unique financial situations into elements for the actionable implementation of contemporary strategic and tactical plans.
- MFIN graduates will employ the skills needed to modify the analytical and critical thinking processes and adapt to the needs of other business units such as accounting, marketing, supply chain, and other firm-specific business units.

- Primary Learning Objectives:
- MFIN graduates will be skilled at evaluating the impact of various courses of action and assess the impacts on multiple stakeholders, including investors, lenders, employees, customers, vendors, and society.

5. Value System: (Professional Practice) - MFIN graduates will be able to evaluate the ethical and societal implications of the strategic decision-making for which they are involved and responsible.

Primary Learning Objectives:

- MFIN graduates will be skilled at evaluating the impact of various courses of action and assess the impacts on multiple stakeholders, including investors, lenders, employees, customers, vendors, and the implications to society and the community.

Contact

Campus	University Park
Graduate Program Head	Kimberly J Cornaggia
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Jason Lunn
Program Contact	Andrea Lyn Murphy-Faust 220 Business Building University Park PA 16802 alm205@psu.edu (814) 863-0474
Program Website	View (https://mfin.smeal.psu.edu/)

Food Science

Graduate Program Head	Robert F. Roberts
Program Code	FDSC
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Dual-Title Ph.D. in Food Science and Clinical and Translational Science Dual-Title Ph.D. and M.S. in Food Science and International Agriculture and Development
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=FDSC)

Graduate work leading to the M.S. and Ph.D. degrees in Food Science is directed toward a multidisciplinary and integrated approach to teaching and research relevant to processing and manufacture of value-added foods from agricultural commodities. Through integration of the disciplines of chemistry, microbiology, engineering, and nutrition, students learn to ensure that consumers can make healthful choices from an abundant supply of affordable, safe, nutritious, and appealing foods.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to

Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students with a 3.00 junior/senior average (on a 4.00 scale) will be considered for admission to the program. Exceptions may be made at the discretion of the program.

Best preparation for graduate work in Food Science is the completion of an undergraduate degree in food science, biochemistry, chemistry, chemical engineering, microbiology, or other related areas. The undergraduate program must include calculus, organic chemistry, microbiology, and general physics. Students may be provisionally admitted (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/provisional-admission/>) with deficiencies but are required to make them up without degree credit. GRE scores will not be accepted.

Students are generally admitted directly to a master's program unless they have previously earned an M.S. degree in food science or an appropriate related area.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A minimum of 30 credits at the 400, 500, 600 or 800 level is required, with at least 18 credits in the 500 and 600 series, combined. There are 24 credits required in the following core courses:

Code	Title	Credits
Required Courses		
FDSC 500A	Fundamentals of Food Science - Microbiology	1
FDSC 500B	Fundamentals of Food Science - Engineering	1
FDSC 500C	Fundamentals of Food Science - Chemistry	1
FDSC 500D	Fundamentals of Food Science - Nutrition	1
FDSC 501	Research Methods in Food Science	2
6 credits of other 500-level FDSC courses (3 credits of the requirement can be satisfied by 400-level Food Science courses with permission of the adviser.)		6
6 credits of 400- or 500-level courses - must include Statistics (STAT 500 or equivalent)		6
Electives		
The remaining 6 credits may be chosen from a list of approved electives maintained by the program office.		6
Culminating Experience		
FDSC 600	Thesis Research	6
Total Credits		30

In addition, M.S. students are required to complete 1 credit of FDSC 602: Supervised Experience in College Teaching prior to the TA experience; however, this 1 credit cannot be counted towards the minimum 30 credits required.

The M.S. degree also requires the formation of a master's committee, the writing of a satisfactory thesis accepted by the master's committee, the head of the graduate program, and the Graduate School, and the passing of a final oral examination.

International students must also take the American English Oral Communicative Proficiency Test (AEOCPT).

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A minimum of 12 credits is required for the Ph.D. degree; Ph.D. students who did not complete an M.S. in Food Science or related field must complete 12 additional credits, for a minimum of 24 credits:

Code	Title	Credits
Required Courses		
FDSC 500A	Fundamentals of Food Science - Microbiology ¹	1
FDSC 500B	Fundamentals of Food Science - Engineering ¹	1
FDSC 500C	Fundamentals of Food Science - Chemistry ¹	1
FDSC 500D	Fundamentals of Food Science - Nutrition ¹	1
FDSC 501	Research Methods in Food Science ¹	2
6 credits of other 500-level FDSC courses (3 credits of the requirement can be satisfied by 400 level Food Science courses with permission of the adviser.)		6
Students must have satisfactorily completed at least one 400 or 500-level course in statistics (i.e., STAT 500 Applied Statistics or equivalent), during their undergraduate or graduate program		
Total Credits		12

¹ Not needed if student received credit for these courses during master's degree program at Penn State.

In addition, Ph.D. students are required to complete 1 credit of FDSC 602: Supervised Experience in College Teaching prior to the TA experience; however, this 1 credit cannot be counted towards the minimum credits required for the degree.

Except in special cases, an M.S. in Food Science is earned before pursuing a Ph.D. degree. Although most applicants to the Ph.D. program have already obtained a master's degree in Food Science or a related program, the M.S. degree is not a prerequisite for entrance into the doctoral program. For students entering the Ph.D. program without having earned an M.S. degree in Food Science or related field, 12 additional credits are required:

- FDSC 600, 6 credits
- Additional 400 or 500-level FDSC courses, 6 credits

All doctoral students must pass a qualifying examination, a comprehensive written and oral examination, and a final oral examination (the dissertation defense). To earn the Ph.D. degree, doctoral students must also write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School. In addition, all Food Science Ph.D. candidates are assessed for English competency. International students must also take the American English Oral Communicative Proficiency Test (AEOCPT).

Dual-Titles

Dual-Title Ph.D. in Food Science and Clinical and Translational Sciences

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Students must apply and be admitted to the graduate program in Food Science and the Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the CTS dual-title program. Refer to the Admission Requirements section of the CTS Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/clinical-translational-sciences/>). Doctoral students must be admitted into the dual-title degree program in CTS prior to taking the qualifying examination in their primary graduate program.

An admissions committee comprised of faculty affiliated with the dual-title program will evaluate applicants. Applicants must have a graduate GPA of at least 3.5. Prospective dual-title program students must include in their application a statement of purpose that addresses the ways in which their research and professional goals will be enhanced by an interdisciplinary course of study in clinical and translational sciences.

The Dual-Title Ph.D. in Food Science and Clinical and Translational Sciences emphasizes interdisciplinary scholarship at the interface of basic sciences, clinical sciences, and human health. Students in the dual-title program are required to have two advisers from separate disciplines: one individual serving as the primary mentor from the Graduate Program in Food Science and another individual serving as the secondary mentor from an area covered by the dual-title program who is a member of the Clinical and Translational Sciences faculty.

Degree Requirements

To qualify for the dual-title degree in Food Science and Clinical and Translational Sciences, students must satisfy the Food Science Ph.D. degree requirements listed in the Degree Requirements section. In addition, students must complete the degree requirements for the dual-title CTS, listed on the CTS Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/clinical-translational-sciences/>). Approximately 6 credits of course work may overlap with elective courses required by the Ph.D. program in Food Science.

For students in the dual-title program, the qualifying examination consists of the standard Food Science qualifying exam with one modification. A member of the CTS Graduate Faculty will join the standing FDSC qualifying examination committee during the normal FDSC exam and assess the student's CTS knowledge. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. This occurs by assigning the student a paper that has clinical relevance, or by asking the student questions that require him or her to extend the assigned paper into a clinical/translational context. This examination must be completed before the end of the second year, within four semesters (summer sessions do not count) of entry into the doctoral program.

The student's Ph.D. committee will include Graduate Faculty from Food Science and Graduate Faculty from Clinical and Translational Science. In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the

Ph.D. committee of a Food Science and CTS dual-title doctoral degree student must include at least one member of the CTS Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee representing Food Science is not also a member of the Graduate Faculty in CTS, the member of the committee representing CTS must be appointed as co-chair.

The fields of food science and clinical and translational sciences will be integrated in the student's comprehensive examination. The CTS representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

All dual-title students are required to conduct dissertation research that contributes fundamentally to the fields of food science and clinical and translational sciences. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title M.S. and Ph.D. in Food Science and International Agriculture and Development

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Graduate students with research and educational interests in international agriculture and development may apply to the dual-title degree program in Food Science and INTAD. The goal of the dual-title degree program in Food Science and INTAD is to enable graduate students from Food Science to acquire the knowledge and skills of their primary area of specialization in Food Science, while at the same time gaining the perspective and methods needed for work in international agriculture. Graduate study in this program seeks to prepare students to assume leadership roles in science, science education, outreach, and project management anywhere in the world. Students are required to write research proposals and expected to write grants to support their research activities, reflecting the dual-title degree. As part of their professional development presentations, publication of research articles and active participation in professional societies is expected. Emphasis is placed upon the professional development of the student. Students can specialize in the research program areas of:

- food chemistry,
- food microbiology,
- food engineering,
- effects of processes on nutrition,
- sensory science,
- bioactive components,
- human gut microbiome,
- food processing, and
- extension education.

INTAD students will acquire a broad perspective on how to apply their research findings in the context of the broader international community. Thus, the dual-title will allow students to master their field of specialization from an international perspective so that they can compare practices and outcomes between countries and regions.

Admission Requirements

For admission to the dual-title graduate degree under this program, a student must first apply and be admitted to the Food Science graduate program and the Graduate School. Once accepted into the Food Science program, the student can apply to the INTAD Academic Program Committee for admission to the dual-title degree program. The student must obtain consent from their Food Science adviser prior to applying to the INTAD program. Refer to the Admission Requirements section of the INTAD Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/international-agriculture-development/>). Ph.D. students must apply and be admitted to the dual-title degree program in International Agriculture and Development prior to taking the qualifying exam.

Degree Requirements for the Dual-Title M.S.

To qualify for this dual-title degree, students must satisfy the requirements of the Food Science Master of Science degree program, described under Degree Requirements. In addition, they must satisfy INTAD program requirements for the dual-title master's degree (<http://bulletins.psu.edu/graduate/programs/majors/international-agriculture-development/>). Some courses may satisfy both Food Science program requirements and those of the INTAD program. Final course selection must be approved by the student's advisory committee.

Degree Requirements for the Dual-Title Ph.D.

To qualify for this dual-title degree, students must satisfy the requirements of the Food Science Ph.D. program, described under Degree Requirements. In addition, they must satisfy INTAD program requirements for the dual-title Ph.D. degree (<http://bulletins.psu.edu/graduate/programs/majors/international-agriculture-development/>). Some courses may satisfy both Food Science program requirements and those of the INTAD program. Final course selection must be approved by the student's Ph.D. committee.

The Qualifying Examination committee for the dual-title degree will be composed of Graduate Faculty from Food Science and must include at least one Graduate Faculty member from the INTAD program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Food Science and INTAD. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a dual-title doctoral degree student must include at least one member of the INTAD Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the committee representing Food Science is not also a member of the Graduate Faculty in INTAD, the member of the committee representing INTAD must be appointed as co-chair. The INTAD representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students enrolled in the dual-title program are required to write and orally defend a dissertation on a topic that reflects their original research and education in Food Science and INTAD. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be

accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Food Science (FDSC) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/fdsc/>)

Learning Outcomes

Master of Science (M.S.)

1. Know. Graduates will develop a deep conceptual understanding of food chemistry, microbiology, engineering, nutrition.
2. Critical thinking. Graduates will be able to solve practical problems in the Food Science field.
3. Research. Graduates will demonstrate the ability to design scientific approaches to solve practical problems and to select appropriate methods of data analysis.
4. Communicate. Graduates will be able to accurately report the results of research data in field of food science through written and oral presentations.

5. Professional practice. Graduates will conduct themselves in an ethical and professional manner.

Doctor of Philosophy (Ph.D.)

1. Know. Graduates will develop a deep conceptual understanding of food chemistry, microbiology, engineering, nutrition.
2. Critical thinking. Graduates will be able to apply their knowledge to independently identify and define original research problems.
3. Research. Graduates will demonstrate the ability to design scientific approaches to solve unanswered question and to select appropriate methods of data analysis.
4. Communicate. Graduates will be able to accurately report the results of research data in field of food science through written and oral presentations.
5. Professional practice. Graduates will conduct themselves in an ethical and professional manner.

Contact

Campus	University Park
Graduate Program Head	Robert F Roberts
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Greg Ziegler
Program Contact	Karen Mullen 217 Food Science Building University Park PA 16802 kjs15@psu.edu (814) 863-4827 View (http://foodscience.psu.edu/)
Program Website	

Forensic Science

Graduate Program Head	Santhosh Girirajan
Program Code	FRNSC
Campus(es)	University Park (M.P.S.)
Degrees Conferred	Master of Professional Studies (M.P.S.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=FRNSC)

The Master of Professional Studies (M.P.S.) in Forensic Science is a professional master's degree program housed in the Eberly College of Science. The curriculum provides students with innovative, hands-on, multidisciplinary learning approaches to criminalistics, forensic chemistry, forensic molecular biology, crime scene investigation, courtroom proceedings, and relevant ethical and social issues. Students have the option to select from one of two emphases, either forensic chemistry or forensic molecular biology. In addition, students will develop strong research and presentation skills.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The Master of Professional Studies degree in Forensic Science is appropriate for students with a baccalaureate degree in the biological

sciences, chemistry, or a related field of study. Applicants are required to have a minimum cumulative GPA of 3.00 (on a 4.00 scale) in their undergraduate degree. Submission of GRE scores is optional. In addition, each applicant is asked to provide a personal statement describing professional interests and career goals and two letters of reference. Letters of reference should be submitted by the student's undergraduate adviser, research adviser, an instructor for an upper level course taken as part of their major, internship supervisor, or employer (only if the applicant was employed in a position related to forensic science or a relevant natural/physical science). Individuals providing letters of reference will also be required to complete a subjective evaluation of the applicant. Official transcripts from each institution of higher education attended as an undergraduate or graduate student must be submitted. Applicants may be selected for interview by members of the forensic science faculty. Admission to the program is based upon a thorough review of all applicant qualifications.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of Professional Studies (M.P.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Chemistry Emphasis

A minimum of 42 credits are required for completion of the program, with at least 18 credits from courses at the 500 and 800-level. Students must take 25 credits of required coursework, 11 additional credits of Chemistry-based coursework, and at least 6 credits of Elective coursework. Elective credits are selected from courses that are determined appropriate based on educational interest and career track. A research project with a comprehensive research paper of publication quality, and accompanying oral presentation, serve as the culminating experience for completion of the M.P.S. in Forensic Science.

Molecular Biology Emphasis

A minimum of 42 credits are required for completion of the program, with at least 18 credits from courses at the 500 and 800-level. Students must take 25 credits of required coursework, 11 additional credits of Molecular Biology-based coursework, and at least 6 credits of Elective coursework. Elective credits are selected from courses that are determined appropriate based on educational interest and career track. A research project with a comprehensive research paper of publication quality, and accompanying oral presentation, serve as the culminating experience for completion of the M.P.S. in Forensic Science.

Code	Title	Credits
Required Courses		
FRNSC 400	Courtroom Proceedings and Testimony	1
FRNSC 410	A Scientific Approach to Crime Scene Investigation	2
FRNSC 411	Criminalistics: Trace and Impression Evidence	3
FRNSC 413	Criminalistics: Biology	3
FRNSC 415W	Laboratory in Crime Scene Investigation	2
FRNSC 532	Drug Chemistry and Toxicology	3

FRNSC 801	Professional Development in Forensic Science ¹	3
FRNSC 841	Forensic Seminar Series	1
FRNSC 861	Ethics in Forensic Science	1

Additional Courses

Select an emphasis area and complete required course work from a list of approved emphasis courses maintained by the program office.	11
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Electives

Select at least 6 credits of 400, 500, or 800 level coursework relevant to the emphasis in consultation with a program adviser.	6
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Culminating Experience

FRNSC 894	Research Projects in Forensic Science (Research paper and oral presentation.)	6
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Total Credits 42

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Two scholarship opportunities are available for Forensic Science graduate students are the Walter K. and Lynn-Marie C. Wieland Graduate Scholarship in Forensic Science and the William Elwood Graduate Student Scholarship in Forensic Science. The Wieland Scholarship provides full tuition and stipend for one student based on academic excellence. The Elwood Scholarship provides an award based on academic excellence.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate

student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Forensic Science (FRNSC) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/frnsc/>)

Learning Outcomes

1. **KNOW:** Students will develop an understanding of the scientific principles of crime scene investigation and reconstruction, including evidence collection and preservation.
2. **APPLY/CREATE:** Students will receive intensive hands-on training in forensic laboratory methodologies with respect to the analysis of evidence.
3. **COMMUNICATE:** Students will develop written communication skills for presentation of their findings in accordance with established professional guidelines.
4. **COMMUNICATE:** Students will develop oral communication skills for discussing the scientific method in a laboratory setting and effectively testifying in a court of law.
THINK: Students will develop an understanding of the importance of the interaction between law enforcement, scientists and the legal profession.
5. **PROFESSIONAL PRACTICE:** Students will develop an understanding of the importance of professionalism and ethical behavior in the forensic science community.

Contact

Campus	University Park
Graduate Program Head	Santhosh Girirajan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Jason Brooks
Program Contact	Cait Mossbrook 329 Whitmore Laboratory University Park PA 16802 cjm5608@psu.edu
Program Website	View (https://science.psu.edu/bmb/forensics/)

Forest Resources

Graduate Program Head	Margot Kaye
Program Code	FORR
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Dual-Title Ph.D. and M.S. in Forest Resources and Transdisciplinary Research on Environment and Society Dual-Title Ph.D. and M.S. in Forest Resources and International Agriculture and Development Dual-Title Ph.D. and M.S. in Forest Resources and Operations Research
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=FORR)

The Doctor of Philosophy and the Master of Science degree programs are oriented toward research, education, and scientific technology in the professions of forest products and forestry.

Faculty expertise, laboratories, and outdoor facilities are available to support specialization in a variety of fields. Possibilities for specialization are indicated in part by the courses listed under wood products, forestry, and wildlife and fisheries, and by related courses in:

- agricultural economics,
- agronomy,
- animal nutrition,
- biology,
- business administration,
- chemical engineering,
- computer science,
- ecology,
- economics,
- entomology,
- environmental pollution control,
- environmental resource management,
- genetics,
- horticulture,
- industrial engineering,
- landscape architecture,
- meteorology,
- physiology,
- plant pathology,
- polymer sciences,
- recreation and parks,
- regional planning,
- statistics.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate->

admissions/how-to-apply/). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Scores from the Graduate Record Examinations (GRE) are not required for admission but may be submitted if desired by the applicant.

For admission, an applicant should have at least a 2.75 grade-point average, a 3.00 junior/senior average (on a 4.00 scale), and courses that are basic to the individual's field of specialization. Ordinarily, these include:

- 12 credits in communication;
- 12 credits in social sciences and humanities;
- 10 credits in quantification, including calculus and statistics;
- 8 credits in chemistry and/or physics;
- 8 credits in biological sciences; and
- 18 credits in forest products, forestry, fish, wildlife, or related courses.

Three reference letters and a brief statement describing the applicant's academic goals, career interests, and special qualifications are required. The best-qualified applicants will be accepted up to the number of spaces available. Exceptions to admission requirements may be made for students with special backgrounds, abilities, and interests, at the discretion of the program.

Admission to the Ph.D. program in Forest Resources requires a master's degree in Forest Resources or a closely related field, or a bachelor's degree with a minimum grade-point average of 3.30 and demonstrated research ability.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A minimum of 30 credits at the 400, 500, 600, or 800 level is required, with least 18 credits at the 500 and 600 level, combined. The department requires 12 credits of 400- or 500-level formal courses in Forestry (FOR) of which 6 must be 500-level. At least 6 credits of 400- or 500-level courses (usually STAT) are required in courses that cover topics such as analysis-of-variance, correlation, regression, and design of experiments; the courses that will satisfy this requirement must be approved by the student's committee. Participation in at least one colloquium course each semester is expected and students must complete at least 1 credit of colloquium (FOR 590). In addition, specific courses and requirements will be determined by the faculty adviser and advisory committee.

A thesis based on field or laboratory research is required for the M.S. degree and at least 6 credits in thesis research (FOR 600 or FOR 610) must be taken in conjunction with completing the thesis. The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School, and the student must pass a thesis defense.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

While a minimum number of courses for the degree is not specified, the Ph.D. committee has the responsibility of specifying courses and credits essential for the education and development of the student. Students are expected to be educated in depth in a specific subfield of Forestry (FOR) and to have a perspective of the general field. Normally, students will have 50 to 60 credits in formal course work beyond the B.S. degree.

Doctoral students are required to participate regularly in a departmental colloquium and to register for at least 1 credit of Colloquium (FOR 590) during the Ph.D. program. Ph.D. students are required to complete two separate semesters of Supervised Experience in College Teaching (FOR 602) for 2 credits total; however, these 2 credits cannot be counted towards the degree requirements. Doctoral students must pass a qualifying examination, a comprehensive written and oral examination, and a final oral examination (the dissertation defense). To earn the Ph.D. degree, doctoral students must also write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Titles

Dual-Title M.S. and Ph.D. in Forest Resources and TRANSDISCIPLINARY RESEARCH ON ENVIRONMENT AND SOCIETY

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Students must apply and be admitted to the graduate program in Forest Resources and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the TREES dual-title program. Doctoral students should enroll in a dual-title graduate degree program early in their training, and no later than the end of the fourth semester (not counting summer semesters) of entry into the graduate major program. Refer to the Admission Requirements section of the TREES Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/transdisciplinary-research-environment-society/>).

Degree Requirements for the Dual-Title M.S.

To qualify for the dual-title degree, students must satisfy the degree requirements for the M.S. degree in Forest Resources, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual title in TREES, listed on the TREES Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/transdisciplinary-research-environment-society/>).

Degree Requirements for the Dual-Title Ph.D.

To qualify for the dual-title degree, students must satisfy the degree requirements for the Ph.D. degree in Forest Resources, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual title in TREES, listed on the TREES Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/transdisciplinary-research-environment-society/>).

The qualifying examination for Forest Resources will satisfy the qualifying exam requirement for the dual-title degree program in TREES. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying

examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees, the Ph.D. committee of a Forest Resources and TREES dual-title Ph.D. student must include at least one member of the TREES Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in TREES, the member of the committee representing TREES must be appointed as co-chair. The TREES representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Forest Resources and TREES. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title M.S. and Ph.D. in Forest Resources and International Agriculture and Development

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Graduate students with research and educational interests in international agriculture and development may apply to the dual-title degree program in Forest Resources and International Agriculture and Development. The goal of the dual-title degree FORR and INTAD graduate program is to enable graduate students from FORR to acquire the knowledge and skills of their primary area of specialization in FORR, while at the same time gaining the perspective and methods needed for work in the international agriculture. Graduate study in this program seeks to prepare students to assume leadership roles in science, engineering, outreach, and project management anywhere in the world. Students acquire a broad perspective on how to apply their research findings in the context of the broader international community. Thus, the dual-title will allow students to master their field of specialization from an international perspective so that they can effectively engage in agricultural development activities within various countries and regions.

Admission Requirements

Students must apply and be admitted to the graduate program in FORR and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the INTAD dual-title program. Refer to the Admission Requirements section of the INTAD Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/international-agriculture-development/>). Doctoral students must be admitted into the dual-title degree program in INTAD prior to taking the qualifying examination in their primary graduate program.

Degree Requirements for the Dual-Title M.S.

To qualify for the dual-title degree, students must satisfy the degree requirements for the M.S. degree, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual-title M.S. in INTAD, listed on the INTAD Bulletin page ([http://bulletins.psu.edu/graduate/programs/majors/international-agriculture-](http://bulletins.psu.edu/graduate/programs/majors/international-agriculture-development/)

[development/](http://bulletins.psu.edu/graduate/programs/majors/international-agriculture-development/)). Up to 6 credits of INTAD approved courses can be applied to fulfilling FORR program requirements. Final course selection must be approved by the student's advisory committee.

Degree Requirements for the Dual-Title Ph.D.

To qualify for the dual-title degree, students must satisfy the degree requirements for the Ph.D. degree, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual-title Ph.D. in INTAD, listed on the INTAD Bulletin page. (<http://bulletins.psu.edu/graduate/programs/majors/international-agriculture-development/>) Some courses may satisfy both FORR program requirements and those of the INTAD program. Up to 6 credits of INTAD approved courses can be applied to fulfilling FORR program requirements. Final course selection must be approved by the student's Ph.D. committee.

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from FORR and must include at least one Graduate Faculty member from the INTAD program. Faculty members who hold appointments in both programs' Graduate Faculty may service in a combined role. There will be a single qualifying examination, containing elements of both FORR and INTAD. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed on semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a FORR and INTAD dual-title Ph.D. student must include at least one member of the INTAD Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may service in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in INTAD, the member of the committee representing INTAD must be appointed as co-chair. The INTAD representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in FORR and INTAD. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title M.S. and Ph.D. in Forest Resources and Operations Research

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Students must apply and be admitted to the graduate program in Operations Research and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Operations Research dual-title program. Refer to the Admission Requirements section of the Operations Research Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>). Doctoral students must be admitted into the dual-

title degree program in Operations Research prior to taking the qualifying examination in their primary graduate program.

Degree Requirements for the Dual-Title M.S.

To qualify for the dual-title degree, students must satisfy the degree requirements for the M.S. degree in Forest Resources, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual-title in Operations Research, listed on the Operations Research Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>).

Degree Requirements for the Dual-Title Ph.D.

To qualify for the dual-title degree, students must satisfy the degree requirements for the Ph.D. degree in Forest Resources, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual-title in Operations Research, listed on the Operations Research Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Forest Resources and must include at least one Graduate Faculty member from the Operations Research program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Forest Resources and Operations Research. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Forest Resources and Operations Research dual-title Ph.D. student must include at least one member of the Operations Research Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Operations Research, the member of the committee representing Operations Research must be appointed as co-chair. The Operations Research representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Forest Resources and Operations Research. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Forestry (FOR) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/for/>)

Learning Outcomes

Master of science (M.S.)

1. **KNOW:** Graduates in these three masters programs will have obtained knowledge of core theories and methods as demonstrated by courses completed and grades earned at the bachelor's level. Graduates will exhibit breadth and depth of understanding in their respective disciplines in courses completed at the master's level.
2. **APPLY/CREATE:** Graduates in these three masters programs will be able to clearly synthesize literature and theories in their disciplinary areas and/or in their specialized thesis topics. Such synthesis will help generate new ideas or methods to develop unique solutions to the problems in the three disciplinary programs.
3. **COMMUNICATE:** Graduates in these three masters programs will effectively communicate ideas, arguments, and rationales in clear, concise, well-organized publications (abstracts, papers, proposals) and presentations (conferences, seminars, and research meetings).
4. **THINK:** Graduates in these three masters programs will be able to critically analyze the work of others in their field of specialty. Such analyses will help graduate students to demonstrate proficiency in designing a research strategy to answer important questions and to improve their own work.
5. **PROF. PRACTICE:** Graduates in these three masters programs will demonstrate the highest ethical standards and core values (including

Penn State Core Values) within their discipline and other diverse scientific backgrounds.

Doctor of Philosophy (Ph.D.)

1. **KNOW:** Graduates in these three doctoral programs will have obtained the knowledge of the core theories and methods at the bachelors and/or master's levels. Graduates will exhibit breadth and depth of understanding in their respective disciplines in courses completed at the doctoral level.
2. **APPLY/CREATE:** Graduates in these three doctoral programs will be able to clearly synthesize literature and theories in their disciplinary areas and/or in their specialized thesis/dissertation topics. Such synthesis will help generate new ideas or methods to develop unique solutions to the problems in the three disciplinary doctoral programs.
3. **COMMUNICATE:** Graduates in these three doctoral programs will effectively communicate ideas, arguments, and rationales in clear, concise, well-organized publications (abstracts, papers, proposals) and presentations (conferences, seminars, and research meetings).
4. **THINK:** Graduates in these three doctoral programs will be able to critically analyze the work of others in their field of specialty. Such analyses will help graduate students to demonstrate proficiency in designing a research strategy to answer important questions and to improve their own work.
5. **PROF. PRACTICE:** Graduate students in these three doctoral programs will demonstrate the highest ethical standards and core values (including Penn State Core Values) within their discipline and other diverse scientific backgrounds.

Contact

Campus	University Park
Graduate Program Head	Margot Wilkinson Kaye
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Patrick Joseph Drohan
Program Contact	Nicole Marie Houck Dept of Ecosystem Sci Mngmt 319 Forest Resources Building University Park PA 16802 nmh5631@psu.edu (814) 863-7221
Program Website	View (http://ecosystems.psu.edu/graduateprograms/forest-resources/)

French and Francophone Studies

Graduate Program Head	Adlai Murdoch
Program Code	FFS
Campus(es)	University Park (Ph.D., M.A.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Arts (M.A.) Dual-Title Ph.D. in French and Francophone Studies and African Studies Dual-Title Ph.D. in French and Francophone Studies and Visual Studies Dual-Title Ph.D. and M.A. in French and Francophone Studies and Women's, Gender, and Sexuality Studies
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=FFS)

Graduate programs in French and Francophone Studies generate and analyze culture and society and literature. For example, programs of study can concentrate on such topics as genres, themes, periods, cultural anthropology, philosophy, socio-cultural and literary history, stylistics, urbanism, visual studies, and women's and gender studies. Through varied sites of analysis (city, library, archive, classroom, stage, environment, among others), the program explores past and current issues and theoretical debates. Our interdisciplinary approach to French and Francophone Studies currently gravitates around three major poles: race and gender; cultures and literatures in contact; and aesthetics/poetics.

The M.A. is a general humanistic degree that helps prepare students for a variety of situations, including teaching in private high schools or community colleges, or further graduate work. The Ph.D. is a more specialized degree. The Ph.D. in French and Francophone Studies can be combined with a minor in a field such as social thought. Other potential combinations include our dual-title Ph.D. programs in French and Francophone Studies and Women's, Gender and Sexuality Studies, French and Francophone Studies and African Studies, or French and Francophone Studies and Visual Studies.

Only the faculty members and courses officially associated with the Department of French and Francophone Studies are listed here. Faculty members and courses in other departments are also available to French and Francophone students to help them progress in their training.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Scores from the Graduate Record Examinations (GRE) are not required. The language of instruction at Penn State is English (however, courses in French and Francophone Studies are typically taught in French). English proficiency test scores (TOEFL/IELTS) may be required for international applicants. Consult the English Proficiency section of the Graduate Bulletin Application and Admission Procedures page (<http://>

bulletins.psu.edu/graduate/generalinformation/admission2/) for more information.

Minimum qualifications for admission to the program typically include a B.A. in French or the equivalent, a minimum of 3.20 grade-point average (on a 4.0 scale), and the ability to speak and write in both French and English. A speech sample demonstrating the applicant's ability to speak extemporaneously and coherently about his/her study and career goals in French for Anglophones, in English for Francophones, and in French and English for speakers of other foreign languages is required. A written text on a literary or cultural topic also must be submitted in French for Anglophones and speakers of other foreign languages, and in English for Francophones. The best-qualified applicants will be accepted up to the number of spaces that are available for new students. Exceptions to the minimum 3.20 GPA may be made for students with special backgrounds, abilities, and interests, at the discretion of the program.

Degree Requirements

Master of Arts (M.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Candidates for the master's degree in French and Francophone Studies must complete a minimum of 33 credits at the 400, 500, 600, or 800 level, either 33 credits plus a master's paper or 27 credits plus 6 credits for a thesis. A reading knowledge of a second foreign language plus oral and written examinations are also required.

The M.A. degree (or equivalent) is normally a prerequisite to apply to the doctoral program. Students who complete a thesis must take at least 6 credits in thesis research (FR 600 or FR 610). The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School, and the student must pass a thesis defense. Students who complete a master's paper do so by building on ideas or concepts from one of their graduate courses, including a faculty member's feedback and suggestions for further developing a final paper.

Code	Title	Credits
Required Courses		
FR 571	French Literary Theory and Criticism	3
FR 502	Introduction to French Linguistics	3
FR 580	Approaches to French Civilization	3
FR 581	Theory and Techniques of Teaching French	1-6
FR 501A	Pro-Seminar in French Studies I	1.5
FR 501B	Pro-Seminar in French Studies II	1.5
6 3-credit courses in French and Francophone Studies		18

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The Ph.D. degree prepares students for careers in teaching and research at the college or university level. Between 33 and 36 credits beyond the M.A. in French and Francophone Studies (or equivalent) is required in course work at the 400, 500, 600, or 800 level. Students who have not taken these courses while completing their M.A. at Penn State must take FR 571 French Literary Theory and Criticism (3), FR 580 Approaches to

French Civilization (3), FR 581 Theory and Techniques of Teaching French (1-6), FR 501A Pro-Seminar in French Studies I (1.5), and FR 501B Pro-Seminar in French Studies II (1.5). Credits must be distributed in one of two areas of specialization: culture and society or literature.

Doctoral students must demonstrate either an advanced knowledge of one foreign language other than French or a reading ability of two foreign languages other than French (equivalent to the 12-credit level). The foreign language requirement must be completed prior to scheduling the qualifying exam. All doctoral students must pass a qualifying examination, a comprehensive written and oral examination, and a final oral examination. To earn the Ph.D. degree, doctoral students must also write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Titles

Dual-Title Ph.D. in French and Francophone Studies and African Studies

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

French and Francophone Studies doctoral students who have research and educational interests in African studies may apply to the dual-title doctoral degree program in African Studies. The goal of the program is to enable doctoral students from French and Francophone Studies to complement their knowledge and skills in their primary discipline with in-depth knowledge of prevailing theories on and problem-solving approaches to thematic, regional, or national issues pertaining to African development and change.

The dual-title doctoral degree program will provide interested French and Francophone Studies doctoral students with a multidisciplinary approach that will enhance their analytical capabilities for addressing key issues in African Studies.

Admission Requirements

Students must apply and be admitted to the graduate program in French and Francophone Studies and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the African Studies dual-title program. Refer to the Admission Requirements of the African Studies Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/african-studies/>). Applicants interested in the dual-title degree program may make their interest in the program known clearly on their applications to French and Francophone Studies and include remarks in their statement of purpose that address the ways in which their research and professional goals in the primary department reflect an interest in African Studies-related research.

To be enrolled in the dual-title doctoral degree program in African Studies, a student must have the approval of the French and Francophone Studies Department and then submit a letter of application and transcript, which will be reviewed by and African Studies Admissions committee. An applicant must have a minimum grade-point average of 3.0 (on a 4.0 scale) to be considered for enrollment in the dual-title degree program. Students must be admitted into the dual-title degree program in African Studies prior to taking the qualifying examination in French and Francophone Studies.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the requirement of the French and Francophone Studies doctoral program in which they are primarily enrolled. In addition, they must satisfy the requirements described below, as established by the African Studies Program. Within this framework, course selection is determined by the student with the approval in advance of the African Studies Director of Graduate Studies.

Upon acceptance by the African Studies admissions committee, the African Studies director will assign the student an African Studies academic adviser in consultation with the African Studies admissions committee. As a student develops specific scholarly interests, s/he may request a different African Studies from the one assigned by the African Studies admissions committee. The student and the French and Francophone Studies and African Studies academic advisers will establish a program of study that is appropriate for the student's professional objectives and that is in accordance with the policies of the Graduate Council, the French and Francophone Studies graduate program, and the African Studies Program.

The Ph.D. in French and Francophone Studies and African Studies is awarded to students who are admitted to the French and Francophone Studies doctoral program and admitted subsequently into the dual-title degree in African Studies. The minimum course requirements for the dual-title Ph.D. degree in French and Francophone Studies and African Studies are as follows.

Code	Title	Credits
Required Courses		
A minimum of 66 post-baccalaureate credits. Course work accepted for the M.A. in French and Francophone Studies will count toward the credit requirement. At least 48 credits, exclusive of dissertation research credits, must be in French and Francophone Studies.		
18 credits of Africa-related course work at the 400- or 500-level of which the following 9 credits are required: ¹		
AFR 501	Key Issues in African Studies	
a minimum of 6 credits from a list of courses maintained by the African Studies program chair		

¹ The choice of courses in African Studies is to be proposed by the student, subject to approval in advance by the French and Francophone Studies and African Studies academic advisers. The suite of selected courses should have an integrated, intellectual thrust that probes thematic, national, or regional issues and be complementary to the student's specialty in French and Francophone Studies.

- Up to 6 of the 18 credits may come from French and Francophone Studies, as approved by the student's French and Francophone Studies and African Studies Program academic advisers.
- The remaining credits can be taken in African Studies or in any department other than French and Francophone Studies.
- Of the 18 credits, no more than 6 credits may be taken at the 400-level and no more than 3 combined credits may come from 596 and 599 listings.

Language Requirement

Fulfillment of the foreign language requirement will meet the existing French and Francophone Studies requirements.

The foreign language requirement at the doctoral level is designed to provide students with a skill that will aid them in research and in securing

employment. The French and Francophone Studies department feels that the majority of students would profit most from four-skill proficiency in another language. However, some students would benefit most from a reading knowledge of two languages.

Qualifying Examination

The dual-title degree will be guided by the qualifying examination procedure of the French and Francophone Studies graduate program. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable. There will be a single qualifying examination, containing elements of both French and Francophone Studies and African Studies.

The qualifying examination committee for the dual-title degree will be composed of Graduate Faculty from French and Francophone Studies and must include at least one Graduate Faculty member from the African Studies Program. The designated dual-title faculty member may be appointed from French and Francophone Studies if that person holds a formal affiliation with the African Studies program.

Ph.D. Committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a French and Francophone Studies and African Studies dual-title Ph.D. student must include at least one member of the African Studies Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the committee representing French and Francophone Studies is not also a member of the Graduate Faculty in African Studies, the member of the committee representing African Studies must be appointed as co-chair.

Comprehensive Examination

The Comprehensive Examination consists of a series of content-intensive examinations and the doctoral dissertation proposal. The African Studies representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Dissertation and Final Oral Examination

Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. Students enrolled in the dual-title program are required to write and orally defend a dissertation on a topic that reflects their original research and expertise in French and Francophone Studies and African Studies. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title Ph.D. in French and Francophone Studies and Visual Studies

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

French and Francophone Studies graduate students who have research and educational interests in global visual culture may apply to the dual-title doctoral program in Visual Studies. The program aims to (a) provide students with the conceptual and methodological tools they will use to interpret literature, culture and society in French, Francophone and global contexts; (b) generate and analyze ground-breaking research at the intersection of such disciplines as cultural anthropology, philosophy,

socio-cultural and literary history, stylistics, urbanism, visual studies, and women's and gender studies; and (c) guide students in using their specialized knowledge and skills to produce research of publishable quality on varied sites of analysis (city, library, archive, classroom, stage, environment, among others). The program prepares graduates for college and university teaching, and careers in other related fields.

The dual-title Ph.D. in Visual Studies comprises two core components: 1) historical and theoretical analysis of various forms of visual culture, their diverse sources, and their current manifestations; 2) historical and theoretical analysis of visual media in the information age, including the visual aspects of the digital humanities and the presentation of scholarship and teaching in visual media. A program-specific required course in each of these areas will ensure breadth of training for participating students. Together these components will offer students a sophisticated understanding of and ability to intervene in debates about visual culture and visibility in the world today.

Admission Requirements

Students must apply and be admitted to the doctoral program in French and Francophone Studies and The Graduate School before they can apply for admission to the dual-title degree program. Applicants interested in the dual-title degree program may make their interest in the program known clearly in their applications to French and Francophone Studies and include remarks in their statement of purpose that address the ways in which their research and professional goals in the primary department reflect an interest in Visual Studies-related research. After admission to the doctoral program, students must apply for admission to and meet the admissions requirements of the Visual Studies dual-title program, as described in the Admission Requirements section of the Visual Studies Bulletin (<http://bulletins.psu.edu/graduate/programs/majors/visual-studies/>). Doctoral students must be admitted into the dual-title degree program in Visual Studies prior to taking the qualifying examination in the French and Francophone Studies program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the Ph.D. in French and Francophone Studies, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual-title in Visual Studies, listed on the Visual Studies Bulletin (<http://bulletins.psu.edu/graduate/programs/majors/visual-studies/>) page.

The Visual Studies segment of the program will consist of a total of fifteen credits, including two required courses — VSTUD 501 Visual Culture Theory and History and VSTUD 502 Visual Studies in Digitality — and three elective courses dealing with questions of visibility, chosen in consultation with the Director of Graduate Studies for French and Francophone Studies. Up to six credits may be double-counted by both the primary graduate program (FFS) and the dual-title. All in all, students must complete a minimum of 66 post-baccalaureate credits for the Ph.D. in French and Francophone Studies and Visual Studies. Course work accepted for the M.A. in French and Francophone Studies will count towards the credit requirement.

The choice of courses in Visual Studies is to be proposed by the student, subject to approval in advance by the French and Francophone Studies and Visual Studies academic advisers. The suite of selected courses should have an integrated, intellectual thrust that probes thematic, national, or regional issues and be complementary to the student's specialty in French and Francophone Studies.

Language Requirements

Fulfillment of the foreign language requirement will meet the existing French and Francophone Studies requirements.

The foreign language requirement at the doctoral level is designed to provide students with a skill that will aid them in research and in securing employment. The French and Francophone Studies department feels that the majority of students would profit most from four-skill proficiency in another language. However, some students would benefit most from a reading knowledge of two languages.

Qualifying Examination

The dual-title degree will be guided by the qualifying examination procedure of the French and Francophone Studies graduate program. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable. There will be a single qualifying examination, containing elements of both French and Francophone Studies and African Studies.

The qualifying examination committee for the dual-title degree will be composed of Graduate Faculty from French and Francophone Studies and must include at least one Graduate Faculty member from the Visual Studies Program. The designated dual-title faculty member may be appointed from French and Francophone Studies if that person holds a formal affiliation with the Visual Studies program.

Ph.D. Committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a French and Francophone Studies and a Visual Studies dual-title Ph.D. student must include at least one member of the Visual Studies Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role.

If the chair of the committee representing French and Francophone Studies is not also a member of the Graduate Faculty in Visual Studies, the member of the committee representing Visual Studies must be appointed as co-chair.

Comprehensive Examination

The Comprehensive Examination consists of a series of content-intensive examinations and the doctoral dissertation proposal. The Visual Studies representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Dissertation and Final Oral Examination

Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. Students enrolled in the dual-title program are required to write and orally defend a dissertation on a topic that reflects their original research and expertise in French and Francophone Studies and Visual Studies. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-title M.A. and Ph.D. in French and Francophone Studies and Women's, Gender, and Sexuality Studies

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Students must apply and be admitted to the graduate program in French and Francophone Studies and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admission requirements of the Women's, Gender, and Sexuality Studies dual-title program. Refer to the Admission Requirements section of the Women's, Gender, and Sexuality Studies (<https://bulletins.psu.edu/graduate/programs/majors/womens-gender-sexuality-studies/>) Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/womens-studies/>). Applicants interested in the dual-title degree program may make their interest in the program known clearly on their applications to French and Francophone Studies and include remarks in their statement of purpose that address the ways in which their research and professional goals in the primary department reflect an interest in Women's, Gender, and Sexuality Studies-related research.

To be enrolled in the dual-title M.A. or Ph.D. program in Women's, Gender, and Sexuality Studies, a student must have the approval of the French and Francophone Studies Department and then submit a letter of application and transcript, which will be reviewed by the Women's, Gender, and Sexuality Studies Admissions committee. An applicant must have a minimum grade-point average of 3.2 (on a 4.0 scale) to be considered for enrollment in the dual-title degree program. Students must be admitted into the dual-title degree program in Women's, Gender, and Sexuality Studies prior to taking the qualifying examination in French and Francophone Studies.

Degree Requirements for the M.A.

To qualify for this dual-title degree, students must satisfy the requirements of the French and Francophone Studies Master of Arts degree program, listed on the Degree Requirements tab. In addition, they must satisfy the Women's, Gender, and Sexuality Studies program requirements for the dual-title master's degree. Refer to the Degree Requirements section of the Women's, Gender, and Sexuality Studies (<https://bulletins.psu.edu/graduate/programs/majors/womens-gender-sexuality-studies/>) Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/womens-studies/>). Some courses may satisfy both the graduate primary program requirements and those of the Women's, Gender, and Sexuality Studies program. Final course selection is determined by the student after consulting, in advance, with their French and Francophone Studies and Women's, Gender, and Sexuality Studies advisers.

For students who elect to write the thesis for the dual-title M.A. degree in French and Francophone Studies and Women's, Gender, and Sexuality Studies, the thesis must reflect the student's education and interest in both French and Francophone Studies and Women's, Gender, and Sexuality Studies. All members of the student's thesis committee must be members of the Graduate Faculty. The master's thesis committee must include at least one Graduate Faculty member from Women's, Gender, and Sexuality Studies. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role.

Degree Requirements for the Ph.D.

The dual-title Ph.D. in French and Francophone Studies and Women's, Gender, and Sexuality Studies requires between 30 and 42 credits beyond the master's degree, including:

Code	Title	Credits
Required Courses		
FR 571	French Literary Theory and Criticism	3

FR 580	Approaches to French Civilization	3
WMNST 502	Global Feminisms	3
WMNST 507	Feminist Theory	3
WMNST 509	Feminist Pedagogies	3
	or WMNST 508 Feminist Methodologies	

A further twenty-one credits selected in consultation with the adviser, 21 of which nine credits must be Women's, Gender, and Sexuality Studies approved

Electives

Six credits of elective study

Language Requirement

Second Foreign Language: Reading proficiency in two foreign languages, or advanced level in one foreign language.

Qualifying Examination

The dual-title degree will be guided by the qualifying examination procedure of the French and Francophone Studies graduate program. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable. There will be a single qualifying examination, containing elements of both French and Francophone Studies and Women's, Gender, and Sexuality Studies.

The qualifying examination committee for the dual-title degree will be composed of graduate Faculty from French and Francophone Studies and must include at least one Graduate Faculty member from the Women's, Gender, and Sexuality Studies Program. The designated dual-title faculty member may be appointed from French and Francophone Studies if that person holds a formal affiliation with the Women's, Gender, and Sexuality Studies program.

Ph.D. Committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a French and Francophone Studies and Women's, Gender, and Sexuality Studies dual-title Ph.D. student must include at least two members of the Women's, Gender, and Sexuality Studies Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role.

If the chair of the committee representing French and Francophone Studies is not also a member of the Graduate Faculty in Women's, Gender, and Sexuality Studies, the member of the committee representing Women's, Gender, and Sexuality Studies must be appointed as co-chair.

Comprehensive Examination

The Comprehensive Examination consists of a series of content-intensive examinations and the doctoral dissertation proposal. The Women's, Gender, and Sexuality Studies representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Dissertation and Final Oral Examination

Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. Students enrolled in the dual-title program are required to write and orally defend a dissertation on a topic that reflects their original research and expertise in French and Francophone Studies and Women's, Gender,

and Sexuality Studies. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

French (FR) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/fr/>)

Learning Outcomes

1. Graduates will be able to conduct research that significantly furthers knowledge and theory in the study of either French and Francophone literature or French and Francophone culture and society, and will develop the skills needed to communicate the results of their research within the profession as future scholars and teachers.
2. Graduates will master a variety of theoretical approaches to literature and culture, including semiotics; reader-response criticism; "French Theory;" feminist, queer and postcolonial theories; and narratological and sociological approaches.

3. Graduates will articulate arguments and ideas with rigor and clarity in oral presentations and written formats, according to the conventions of the discipline.
4. Graduates will demonstrate knowledge of scholarly and professional standards in the field through written work and oral presentations, and through interactions with faculty and graduate students both within and outside the Department.
5. Graduates will demonstrate the ability to design course activities and assessments appropriate to courses at various levels.
6. Graduates will master oral and written communication skills in the French language.

Contact

Campus	University Park
Graduate Program Head	Adlai Murdoch
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Emmanuel Jean-Francois
Program Contact	Heather Rutten hxr87@psu.edu (814) 863-0997

Geodesign

Graduate Program Head	Roxi Thoren
Program Code	GEODZ
Campus(es)	World Campus (M.P.S.)
Degrees Conferred	Master of Professional Studies (M.P.S.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=GEODZ)

Geodesign is a rapidly emerging and powerful approach to spatial problem-solving that requires the synthesis of geographic knowledge and scientific data with the best practices of environmental design. Graduates from the Master in Professional Studies (M.P.S.) in Geodesign program will be prepared to take leadership roles in addressing complex environmental design problems in settings ranging from urban design to conservation planning.

The M.P.S. in Geodesign program's goal is to provide practicing professionals with an advanced skill set in geodesign. They will learn to capitalize on the power of spatial knowledge and evolving technologies, identify opportunities that emerge to better inform the design, understand their relevance to particular situations, and assist communities in designing alternative futures based on a unique process that brings all this information into focus.

The M.P.S. in Geodesign program is intended specifically for professionals who are able to participate principally on a part-time basis and at a distance. It is offered exclusively through the World Campus.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to

Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

To be admitted to the program, applicants must be able to meet the following requirements:

1. A completed online Graduate School application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) and payment of the application fee.
2. Personal statement of background and interest in the program, including an outline of possible topic for the individual capstone project (maximum 3-pages).
3. Official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>)
4. TOEFL scores (see below)
5. Three (3) letters of recommendation

Scores from the Graduate Record Examinations (GRE), or from a comparable substitute examination, will be considered, but are not required for admission.

Students with a 3.00 junior/senior average (on a 4.00 scale) will be considered for admission. The best-qualified applicants will be accepted up to the number of spaces available for new students. Exceptions to the minimum 3.00 grade-point average may be made for students with special backgrounds, abilities, and interests.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of Professional Studies (M.P.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students earn the M.P.S. in Geodesign degree by successfully completing a minimum 35 credits of course work, including a supervised individual study project. Course requirements include a minimum of 18 credits at the 500 level or above, with a minimum of 6 credits at the 500 level. Note that because most of the available elective courses are worth 3 credits, many students are likely to take at least 36 credits (9 elective credits) to complete their degree program.

The individual study capstone project is the culminating experience for the graduate degree and requires the student to apply the geodesign framework to a real-world challenge, of his/ her choosing, in order to demonstrate aptitude in analytic, design, and collaborative skills. For most students the project will culminate in a formal public presentation, attended by the student's adviser, who is member of the Graduate Faculty at Penn State. If the adviser is unable to attend, the department will send a representative from the Graduate Faculty. The presentation will take place at an appropriate professional conference, approved in consultation with the project adviser. Typically the presentation will be at an annual conference (at the national, regional or state level) of professional organizations, such as the American Planning Association, American Society of Landscape Architects, the Urban and Regional

Information Systems Association, ESRI User Conferences, or other suitable professional organization- affiliated venues. The final venue selection will be one that is mutually agreeable between the student and adviser as to location and appropriate level of professional rigor. Alternatively, students who will be unable to attend a conference, or have other professional objectives, may work with their adviser to get approval to write and submit a project report as an article for an appropriate peer-reviewed journal. The student will provide the adviser with the article, who will in turn recommend final submission to the journal. This will provide an alternative path to successfully complete the culminating experience. Presentations and papers are preceded by dress rehearsals that are open to all students in the program through Web and audio conferencing. As part of his or her individual studies, every student is expected to contribute a formal peer review of one other student's rehearsal.

An Advisory Board consisting of accomplished design, geography and planning professionals in government and industry, as well as Penn State faculty members in a variety of disciplines, guides the ongoing development of the curriculum. Based on taking courses on a part-time basis and at a distance, the curriculum will take at a minimum two-and-a-half years to complete.

Code	Title	Credits
Required Courses		
GEODZ 511	Geodesign History, Theory, Principles	3
GEODZ 822	GeoDesign Models I: Evaluation and Decision	3
GEODZ 824	GeoDesign Models II: Process and Impact	3
or GEODZ 826	GeoDesign Models III: Representation and Change	
GEODZ 842	Geodesign Studio I: Rural/Regional Challenges	6
GEODZ 852		6
Electives		
Select three courses (at least 8 credits) of GEOG courses at the 400 level or higher; courses must be approved in advance by the student's adviser. A list of acceptable electives is maintained by the program office.		8
Culminating Experience		
GEODZ 596A	Individual Studies—Geodesign Capstone Project Proposal and Peer Review	3
GEODZ 596B	Individual Studies—Geodesign Capstone Project Dissemination	3
Total Credits		35

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)

- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Geodesign (GEODZ) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/geodz/>)

Contact

Campus	World Campus
Graduate Program Head	Roxi Thoren
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Stuart Patton Echols
Program Contact	David Eric Goldberg 121 STUCKEMAN FAMILY BLDG University Park PA 16802 deg112@psu.edu (814) 865-4148
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/geodesign-masters/overview/)

Geographic Information Systems

Graduate Program Head	Anthony C. Robinson
Program Code	GIS
Campus(es)	World Campus (M.G.I.S.)
Degrees Conferred	Master of Geographic Information Systems (M.G.I.S.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=GIS)

The Master of Geographic Information Systems (M.G.I.S.) degree is awarded to students who demonstrate mastery of the technical competencies and leadership skills required to design, manage, and use geographic information technologies in a wide range of professional fields.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Additional requirements imposed by the Department of Geography include:

- Statement of professional experience and goals. A résumé should be attached as a supplement, but the statement itself should be an essay (two to three pages) that demonstrates the applicant's written communication skills and clarifies the applicant's objectives in completing the degree program;
- Two letters of recommendation that attest to the applicant's readiness for graduate study;
- Official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>), including the institution that conferred the applicant's baccalaureate degree (and any graduate degrees, if applicable);
- Test of English as a Foreign Language (TOEFL) or International English Language Testing System (IELTS) score, if applicable;
- Nonrefundable application fee.

Applications will be evaluated by the M.G.I.S. Admissions Committee based on the applicants' technical qualifications for the program relative to their previous educational experience, academic interests, and English Language proficiency. In general, successful applicants are expected to have earned an undergraduate grade-point average of at least 3.0 on a 4.0 scale. Applicants with a marginal record are encouraged to first complete a related Graduate Certificate before applying for admission to the M.G.I.S. program. Exemplary performance in the Graduate Certificate will be taken into consideration for possible admission into the M.G.I.S. program, but completion of a certificate does not imply or guarantee admission into a degree program.

Credits earned at other institutions but not used to earn a degree may be applied toward the requirements for a graduate degree, subject to restrictions outlined in GCAC-309 Transfer Credit. (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>)

Degree Requirements

Master of Geographic Information Systems (M.G.I.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students earn the M.G.I.S. degree by successfully completing 33 credits of course work, including a supervised culminating project. Course

requirements include a minimum of 18 credits at the 500 or 800 level, with at least 6 credits at the 500 level.

The culminating experience for the degree is an independent project completed while enrolled in GEOG 870. The independent project completed in GEOG 870 demonstrates the student's ability to apply advanced knowledge and skills related to geographic information systems in a way that makes a substantial contribution to their professional work. The culminating experience will include a formal presentation and scholarly paper.

Code	Title	Credits
Required Courses		
GEOG 482 or GEOG 581	Making Maps That Matter With GIS Spatial Data Science Ethics	3
GEOG 483	Problem-Solving with GIS	3
GEOG 484	GIS Database Development	3
GEOG 583	Geospatial System Analysis and Design	3
GEOG 871	Geospatial Technology Project Management	3
GEOG 586	Geographical Information Analysis	3
Electives		12
Culminating Experience		
GEOG 870	Capstone in Geographic Information Systems	3
Total Credits		33

In lieu of specified prescribed and elective courses, M.G.I.S. students may elect to substitute those for courses that comprise an option. There are two option choices: Geospatial Intelligence Option (15 credits) and Geodesign Option (12 credits).

Geospatial Intelligence Option

M.G.I.S. students who choose to complete the Geospatial Intelligence Option may substitute the 15 credits that comprise the option for 15 credits of prescribed and elective courses (including GEOG 482 or GEOG 864, GEOG 483, and GEOG 484). This option is designed for current or aspiring practitioners in government agencies, businesses, and non-governmental organizations that rely on insights produced through skillful, knowledgeable, and conscientious analysis of diverse geo-referenced data to plan for emergencies, to coordinate responses to natural and human induced disasters, to enforce the law, and to plan and conduct military operations.

Code	Title	Credits
Required Courses		
GEOG 583	Geospatial System Analysis and Design	3
GEOG 586	Geographical Information Analysis	3
GEOG 871	Geospatial Technology Project Management	3
Geospatial Intelligence Option Courses		
GEOG 571	Intelligence Analysis, Cultural Geography, and Homeland Security	3
GEOG 882	Geographic Foundations of Geospatial Intelligence	3
GEOG 883	Remote Sensing Image Analysis and Applications	3
GEOG 884	Spatial Data Science and Intelligence Analysis	3
GEOG 885	Analytical Methods and GeoAI in Geospatial Intelligence	3
Electives		6
Culminating Experience		

GEOG 870	Capstone in Geographic Information Systems	3
Total Credits		33

Geodesign Option

In lieu of 3 credits of a prescribed introductory course (GEOG 484) plus 9 additional elective credits, M.G.I.S. students may substitute 12 credits associated with courses that comprise the Geodesign Option. This option is designed for current or aspiring professionals in government agencies, businesses, and non-profit organizations who see limitations in current regional and urban planning and design approaches, and who seek a foundation in geospatially-based design through investigating the methods and collaborative nature of the Geodesign process.

Code	Title	Credits
Required Courses		
GEOG 482 or GEOG 581	Making Maps That Matter With GIS Spatial Data Science Ethics	3
GEOG 483	Problem-Solving with GIS	3
GEOG 583	Geospatial System Analysis and Design	3
GEOG 586	Geographical Information Analysis	3
GEOG 871	Geospatial Technology Project Management	3
Geodesign Option Courses		
GEOZ 511	Geodesign History, Theory, Principles	3
GEOZ 822	GeoDesign Models I: Evaluation and Decision	3
GEOG 487	Environmental Challenges in Spatial Data Science	3
GEOG 865	Cloud and Server GIS	3
Electives		3
Culminating Experience		
GEOG 870	Capstone in Geographic Information Systems	3
Total Credits		33

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://>

www.worldcampus.psu.edu/tuition-and-financial-aid/) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Geography (GEOG) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/geog/>)

Learning Outcomes

1. **KNOW:** Graduates will demonstrate the technical and analytical competencies required to effectively design, manage, and apply geographic information technologies to create solutions to challenges in a wide range of professional domains.
2. **APPLY/CREATE:** Graduates will apply geographic information technologies using appropriate data, accepted analytical methods, and evaluation criteria to develop solutions for a variety of complex scenarios.
3. **COMMUNICATE:** Graduates will communicate technical knowledge, including ideas, designs, data analysis, findings, or decision justification in appropriate written and oral presentation formats.
4. **THINK:** Graduates will demonstrate proficiency of geospatial information technology to define problems, create and implementation analytical solutions to address challenges within a variety of domains.
5. **PROFESSIONAL PRACTICE:** Graduates will demonstrate professional standards and ethical practices, engage in professional and community-based service, and develop the skills required to lead geospatial technology organizations.

Contact

Campus	World Campus
Graduate Program Head	Anthony C Robinson
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Anthony C Robinson
Program Contact	Julene A Santiago John A. Dutton e-Education Institute 2217 EES University Park PA 16802 jas9616@psu.edu (814) 865-2557
Program Website	View (https://gis.e-education.psu.edu/mgis/)

Geography

Graduate Program Head	Brian King
Program Code	GEOG
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Dual-Title Ph.D. in Geography and African Studies Dual-Title Ph.D. in Geography and Climate Science Dual-Title Ph.D. and M.S. in Geography and Demography Dual-Title Ph.D. and M.S. in Geography and Transdisciplinary Research on Environment and Society Dual-Title Ph.D. and M.S. in Geography and Operations Research Dual-Title Ph.D. and M.S. in Geography and Women's, Gender, and Sexuality Studies
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=GEOG)

The faculty encourages graduate students to arrange courses of study appropriate to their individual needs and aspirations. Programs in Geography may be directed toward a career in public service, teaching and research, private industry, or one of the many other vocational opportunities open to geographers.

Students typically concentrate their study on topics that fall within the special skills and interests of the faculty. Current specialties include biogeography; cartography; climatology; cultural geography; development studies; economic geography; environmental governance; feminist geography; geo-computation; geographic education; geographic information science; geographic theory; geographic visualization; health geography; human dimensions of global change; landscape ecology; nature and society; political ecology; political geography; population geography; remote sensing; and urban geography.

Our department is organized around the following research clusters: spatial modeling and remote sensing; geospatial big data analytics; environmental change and prediction; justice, ethics, and diversity; population, environment, and governance; and food security and human health.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Scores from the Graduate Record Examinations (GRE) are required for admission, as well as a personal statement.

Students with a 3.00 junior/senior grade-point average (on a 4.00 scale) and with appropriate course work in geography or a related discipline will

be considered for admission to the M.S. program or to the five-year Ph.D. program. Applicants with master's degrees from a high-quality graduate program in geography will be considered for admission to the four-year doctoral program. The best-qualified applicants will be admitted up to the number of places that are available for new students. All students are expected to demonstrate breadth across the discipline of geography.

Baccalaureate students must earn a master's degree before they will be considered for admission to the doctoral program.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Penn State's graduate program in Geography works with incoming students to design programs tailored to their specific interests and needs. Thus there are few formal requirements and a maximum of opportunities for students to pursue their own interests under the guidance of the faculty. Each student's work is supervised by his or her academic adviser and by a committee consisting of two additional members of the Graduate Faculty for M.S. students. The M.S. program is broadly based. It is designed to provide beginning graduate students with basic training in systematic fields, geographical theory, and research techniques.

The M.S. degree may be earned by completing a thesis or two papers. The thesis option requires completion of at least 30 credits at the 400, 500, 600, and 800 level, with at least 18 credits in the 500 and 600 series, combined. If the two-paper option is elected, the student must earn 35 credits at the 400, 500, or 800 level, with at least 18 credits at the 500 level. The master's papers are usually expanded versions of course or semester papers that are of sufficiently high quality that they can be submitted to scholarly journals. At least one of the papers offered to fulfill the M.S. papers requirement must have been written in connection with a departmental course or seminar.

All M.S. students are required to enroll in the following courses during their first year of residence:

Code	Title	Credits
Required Courses		
GEOG 500	Introduction to Geographic Research	3
GEOG 502	Research Scholarship in Geography	3
Select at least three of the following:		3
GEOG 501A		
GEOG 501B		
GEOG 501C		
GEOG 501D		

All M.S. students are required to complete at least one seminar at the 500 level. Supporting courses are chosen in consultation with an entrance committee (in year one) or the adviser (in subsequent years).

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

There are three paths to a Ph.D. One is a five-year Ph.D. with M.S. degree, which is available to students who enter Penn State Geography's graduate program without a master's degree. These students are on an accelerated schedule and earn an M.S. along the way to the Ph.D. The second is a four-year Ph.D., which is available to those students who have already received a master's degree in another program either at Penn State or at another university. The third is an M.S.-to-Ph.D. path, which is available to Penn State Geography M.S. students who decide either to continue into the Ph.D. program after they have started their master's program, or to return for the Ph.D. after having graduated with the M.S. Students on this path are not accelerated and therefore will usually require two years to earn the master's and four years to earn the doctorate.

There is no fixed number of credits; courses are prescribed according to the student's prior experience and academic goals. A student's Ph.D. committee can require reading knowledge and/or demonstrated working knowledge of a foreign language, specialized training in linguistics, or training in computer programming languages, depending on the student's research interest.

All doctoral students are required to enroll in GEOG 500 and GEOG 502 during their first year of residence.

Dual-Titles

Dual-Title Ph.D. in Geography and African Studies

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Geography doctoral students – who are already in the program and who have research and scholarly interests in comparative, sub-regional, national and thematic analyses, environmental change, livelihood systems, socio-economic and political change, and other aspects of African development – may apply to the dual-title doctoral degree program in African Studies. The goal of the dual-title program is to enable graduate students from Geography to complement their knowledge and skills in a major area of geographic specialization with in-depth knowledge of prevailing theories and problem-solving approaches to thematic, regional, or national issues pertaining to African Studies.

The dual-title degree program will provide interested Geography doctoral students with a multidisciplinary approach that will enhance their analytical capabilities for addressing key issues in African development and broad aspects of livelihood change. It thereby will add value to their Geography degree and increase their competitiveness in the job market. The well-rounded, regional specialist who graduates from the program is likely to be employed in an international setting. The program has the potential, therefore, to enhance the reputation of the Geography Department, the College of Earth and Mineral Sciences, the College of the Liberal Arts, and Penn State.

Admission Requirements

Students must apply and be admitted to the graduate program in Geography and The Graduate School before they can apply for admission to the dual-title degree program. Applicants interested in the dual-title degree program may make their interest in the program known clearly on their applications to Geography and include remarks in their statement of purpose that address the ways in which their research and professional goals in Geography reflect an interest in African Studies-related research.

To be enrolled in the dual-title doctoral degree program in African Studies, a student must submit a letter of application and transcript, which will be reviewed by the African Studies Admissions Committee. Refer to the Admission Requirements section of the African Studies (<http://bulletins.psu.edu/graduate/programs/majors/african-studies/>) Bulletin page. Students must apply for enrollment into the dual-title degree program in African Studies prior to taking their qualifying examination.

Academic Advisers and Course Selection

To qualify for the dual-title degree, students must satisfy the requirements of the Geography graduate program. In addition, students must complete the degree requirements for the dual-title in African Studies, listed on the African Studies Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/african-studies/>). Within this framework, final course selection is determined by the student in consultation with the Geography and African Studies academic advisers.

Upon acceptance into the dual-title degree program by the African Studies admissions committee, the student will be assigned an African Studies academic adviser in consultation with the African Studies director and the African Studies admissions committee.

As a student develops specific scholarly interests, s/he may request a different African Studies adviser from the one assigned by the African Studies admissions committee. The student and the Geography and African Studies academic advisers will establish a program of study that is appropriate for the student’s professional objectives and that is in accordance with the policies of the Graduate Council, the Geography graduate program, and the African Studies dual-title graduate degree program.

Requirements for the Geography-African Studies Ph.D.

The Dual-Title Doctoral Degree in Geography and African Studies is awarded only to students who are admitted to the Geography doctoral program and admitted to the dual-title degree program in African Studies. To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Geography, listed in the Degree Requirements section. In addition, students must complete the degree requirements for the dual-title in African Studies, listed on the African Studies Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/african-studies/>). The minimum course requirements for the Dual-Title Ph.D. degree in Geography and African Studies are as follows:

- Completion of all course work and other requirements for the Geography Ph.D.
- 18 credits of Africa-related coursework at the 400-, 500-, or 800-level, of which the following are required:

Code	Title	Credits
AFR 501	Key Issues in African Studies	3
Select at least two of the following:		6
AFR 532	Environment and Livelihoods in Africa	
AFR 534	Political Economy of Energy and Extractive Industries in Africa (Oil and Mining)	
AFR 537	Gender, Sexuality and Islam in Africa: Exploring Contemporary Feminist Scholarship	
SOC/AFR 527	Migration, Urbanization, and Policy in the Developing World	

- As many as 6 of the 18 credits may come from 400-, 500-, or 800-level Geography courses, as approved by the student’s Geography and African Studies Program advisers
- The remaining credits can be taken in AFR or in any department other than Geography; of these, no more than 6 credits may be taken at the 400-level and no more than 3 combined credits may come from AFR 596 and GEOG 596
- Communication and foreign language requirements will be determined by the student and the Geography and African Studies advisers in accordance with the existing Geography language requirements

The choice of electives in African Studies is to be proposed by the student and is subject to approval by the Geography and African Studies academic advisers. The suite of selected courses should have an integrated, intellectual thrust that probes a thematic, national, or regional issue and that complements the student’s specialty in Geography.

Language Requirement

The language requirement for a student in the dual-title doctoral degree program will be determined by the student and the Geography and African Studies Program advisers in accordance with the existing Geography language requirements.

Qualifying Exam

The qualifying exam in Geography is an oral exam designed to help students to “..think analytically and critically in their field of expertise and to understand and apply ideas from other fields of geography to their research domain” (Geography Graduate Student Handbook 2011-2012, p. 30). The format of the qualifying exam for the dual-title degree student will be unchanged from the existing Geography qualifying exam and will be guided directly by the requirements outlined in the Geography Graduate Student Handbook. The only difference from the Geography qualifying exam will be an explicit African studies component. The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Geography and must include at least one Graduate Faculty member from the African Studies program. Faculty members who hold appointments in both programs’ Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Geography and African Studies. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

Ph.D. Committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Geography and African Studies dual-title Ph.D. student must include at least one member of the African Studies Graduate Faculty. Faculty members who hold appointments in both programs’ Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in African Studies, the member of the committee representing African Studies must be appointed as co-chair.

Comprehensive Exam

After completing all course work, doctoral candidates for the dual-title doctoral degree in Geography and African Studies must pass a comprehensive examination that includes written and oral components. Written components will be administered on a student’s major Geography subfields and on African Studies. The African Studies representative

on the student's Ph.D. committee will develop questions for and participate in the evaluation of the oral component of the comprehensive examination. The African Studies component of the exam will be based on the student's thematic, national, or regional area of interest and specialization in African Studies.

Dissertation and Dissertation Defense

Ph.D. students enrolled in the dual-title degree program are required to write a dissertation on a topic that reflects their education and research interest in Geography and African Studies. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title Ph.D. in Geography and Climate Science

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Climate Science is a field devoted to the study of Earth's climate in the past, present, and future. A particular focus is understanding the effects of human activities (anthropogenic impacts) and natural forcing on climate. The Climate Science dual-title degree program is administered by the Department of Meteorology and Atmospheric Science for the participating graduate programs. The dual-title degree program is offered through participating programs in the College of Earth and Mineral Sciences and, where appropriate, other graduate programs in the University. The program enables students from several graduate programs to gain the perspectives, techniques, and methodologies of Climate Science, while maintaining a close association with major program areas of application.

Admission Requirements

Students must be admitted to Geography and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Climate Science dual-title program. Refer to the Admission Requirements section of the Climate Science Bulletin page. (<https://bulletins.psu.edu/graduate/programs/majors/climate-science/>) Students must be admitted into the dual-title degree program in Climate Science no later than the end of the fourth semester (not counting summer semesters) of entry into the primary Ph.D. program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the Ph.D. degree requirements of the Geography graduate program. In addition, they must satisfy the degree requirements for the dual-title in Climate Science, listed on the Climate Science Bulletin page. (<https://bulletins.psu.edu/graduate/programs/majors/climate-science/>)

The qualifying examination in Geography satisfies the qualifying exam requirement for the dual-title degree program in Climate Science.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Climate Science dual-title doctoral degree student must include at least one member of the Climate Science Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D.

committee is not also a member of the Graduate Faculty in Climate Science, the member of the committee representing Climate Science must be appointed as co-chair. The Climate Science representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in both Geography and Climate Science. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the Geography graduate program, and the Graduate School.

Dual-Title M.S. and Ph.D. in Geography and Demography

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Students must apply and be admitted to the graduate program in Geography and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Demography dual-title program. Refer to the Admission Requirements section of the Demography Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/demography/>). Doctoral students must be admitted into the dual-title degree program in Demography prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Geography, listed in the Degree Requirements section. In addition, students must complete the degree requirements for the dual-title in Demography, listed on the Demography Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/demography/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Geography and must include at least one Graduate Faculty member from the Demography program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Geography and Demography. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Geography and Demography dual-title Ph.D. student must include at least one member of the Demography Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Demography, the member of the committee representing Demography must be appointed as co-chair. The Demography representative on the student's Ph.D. committee

will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Geography and Demography. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title M.S. and Ph.D. in Geography and TRANSDISCIPLINARY RESEARCH ON ENVIRONMENT AND SOCIETY

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Students must apply and be admitted to the graduate program in Geography and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the TREES dual-title program. Refer to the Admission Requirements section of the TREES Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/transdisciplinary-research-environment-society/>). Doctoral students should enroll in a dual-title graduate degree program early in their training, and no later than the end of the fourth semester (not counting summer semesters) of entry into the graduate major program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Geography, listed in the Degree Requirements section. In addition, students must complete the degree requirements for the dual title in TREES, listed on the TREES Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/transdisciplinary-research-environment-society/>).

The qualifying examination for Geography will satisfy the qualifying exam requirement for the dual-title degree program in TREES. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees, the Ph.D. committee of a Geography and TREES dual-title Ph.D. student must include at least one member of the TREES Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in TREES, the member of the committee representing TREES must be appointed as co-chair. The TREES representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Geography and TREES. Upon completion of the doctoral dissertation, the

candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title M.S. and Ph.D. in Geography and Operations Research

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Students must apply and be admitted to the graduate program in Geography and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Operations Research dual-title program. Refer to the Admission Requirements section of the Operations Research Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>). Doctoral students must be admitted into the dual-title degree program in Operations Research prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Geography, listed in the Degree Requirements section. In addition, students must complete the degree requirements for the dual-title in Operations Research, listed on the Operations Research Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Geography and must include at least one Graduate Faculty member from the Operations Research program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Geography and Operations Research. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Geography and Operations Research dual-title Ph.D. student must include at least one member of the Operations Research Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Operations Research, the member of the committee representing Operations Research must be appointed as co-chair. The Operations Research representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Geography and Operations Research. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be

accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title M.S. and Ph.D. in Geography and Women's, Gender, and Sexuality Studies

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Students must apply and be admitted to the graduate program in Geography and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Women's, Gender, and Sexuality Studies dual-title program. Refer to the Admission Requirements section of the Women's, Gender, and Sexuality Studies Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/womens-gender-sexuality-studies/>). Doctoral students must be admitted into the dual-title degree program in Women's, Gender, and Sexuality Studies prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Geography, listed in the Degree Requirements section. In addition, students must complete the degree requirements for the dual-title in Women's, Gender, and Sexuality Studies, listed on the Women's, Gender, and Sexuality Studies Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/womens-gender-sexuality-studies/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Geography and must include at least one Graduate Faculty member from the Women's, Gender, and Sexuality Studies program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Geography and Women's, Gender, and Sexuality Studies. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Geography and Women's, Gender, and Sexuality Studies dual-title Ph.D. student must include at least two members of the Women's, Gender, and Sexuality Studies Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Women's, Gender, and Sexuality Studies, the member of the committee representing Women's, Gender, and Sexuality Studies must be appointed as co-chair. The Women's, Gender, and Sexuality Studies representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Geography and Women's, Gender, and Sexuality Studies. Upon

completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Geography (GEOG) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/geog/>)

Learning Outcomes

1. Know: Graduates will demonstrate knowledge of the core theories and methods in geography as well as deeper knowledge of three out of four subfields. Graduates will demonstrate specialized knowledge within their chosen sub-field: Human Geography, Environment-Society, Physical Geography, or Geographic Information Science.
2. Create: Graduates will be able to creatively synthesize theory and literature within their field of specialization. They will be able to generate new ideas and if appropriate formulate hypotheses in geographic knowledge. Graduates will be able to select from a range

of methodological options and create a research framework to provide solutions to geographical problems.

3. Apply: Graduates will be able to carry out independent, original, and ethical research that addresses problems in the subfields of geography.
4. Critical thinking: Graduates will be able to critically analyze work in their field of specialization.
5. Communicate: Graduates will be able to convey ideas or arguments in a professional manner with clear, concise, well-organized papers, proposals, and oral presentations.

Contact

Campus	University Park
Graduate Program Head	Brian H. King
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Trevor Birkenholtz
Program Contact	Cierra Naglowsky 302 Walker Building University Park PA 16802 cbn5240@psu.edu (814) 865-3433
Program Website	View (http://www.geog.psu.edu/)

Geosciences

Graduate Program Head	Donald Fisher
Program Code	GEOSC
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Dual-Title Ph.D. in Geosciences and Astrobiology Dual-Title Ph.D. in Geosciences and Biogeochemistry Dual-Title Ph.D. in Geosciences and Climate Science Dual-Title Ph.D. and M.S. in Geosciences and Operations Research Integrated B.S in Geosciences and M.S. in Geosciences
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=GEOSC)

The Department of Geosciences offers M.S. and Ph.D. degree programs that provide students with a broad background in any of the major areas of geological sciences and intensive research experiences culminating in the preparation of a formal thesis. The goal of the programs is to prepare students for scientific careers in academia, government, or industry. A wide range of faculty interests and exceptional laboratory and other support facilities provide an extensive variety of areas of specialization in which students may choose their course work and research topics, which include:

- aqueous geochemistry
- chemistry and physics of rocks and mineral
- geodynamics
- global change and earth history

- sedimentary geology and paleobiology
- solid earth and applied geophysics
- surficial processes

The research of faculty and students is facilitated through the Biogeochemical Research Initiative for Education (BRIE, an NSF-sponsored graduate program in microbial biogeochemistry), the Petroleum Geosystems Initiative (an industry-sponsored, team-based M.S. program) linking the Department of Geosciences and the Department of Energy and Geo-Environmental Engineering and the Penn State Astrobiology Research Center (PSARC, an NSF-sponsored interdisciplinary program in the origin and evolution of life in the universe, aimed at understanding the connections between the environment and the biota on Earth, especially during the stages of its evolution) as well as the Environment Institute of the College of Earth and Mineral Sciences, including the Earth System Science Center, and the Center for Environmental Chemistry and Geochemistry.

In addition to extensive computing and supercomputing facilities developed in association with the Earth System Science Center, students have access to a wealth of analytical, experimental, and field equipment. State-of-the-art analytical equipment is maintained by the department and the Material Characterization Laboratory. The Department of Geography and the Office for Remote Sensing of Environmental Resources have remote sensing facilities.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Scores from the Graduate Record Examinations (GRE) are not required for admission.

For admission, applicants generally are expected to have a bachelor's degree in some branch of the natural or physical sciences, engineering, or mathematics. An applicant also is expected to have completed standard introductory courses in geosciences, chemistry, physics, and mathematics through integral calculus, plus 15 credits of intermediate-level work in one or a combination of these subjects. Greater than minimal preparation in chemistry, geology, biology, mathematics, or physics may be required for particular subdisciplines. Applicants who have taken somewhat less than the indicated minimum in these subjects may be provisionally admitted (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-303-provisional-admission/>) but must make up their deficiencies concurrently with their graduate studies. Credits for these preparatory courses will not count towards degree requirements.

Students with special backgrounds, abilities, and interests whose undergraduate grade-point average in courses pertinent to geosciences is below a 3.00 (on a 4.00 scale) will be considered for admission only when there are strong indications that a 3.00 average can be maintained at the graduate level.

A student may work toward a Ph.D. degree without first earning a master's degree. If this option is desired, the student must arrange the scheduling of a qualifying evaluation no later than the end of the third semester of residence at Penn State.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Upon arrival, students will be advised initially by a committee appointed by the associate head for graduate program and research. The committee in turn will designate an interim adviser. Before the end of the first academic year of residence, the student is expected to develop specific academic and research interests so that an appropriate permanent academic adviser and research supervisor may be chosen. The academic adviser and research supervisor are usually the same person, except when the research supervisor is not a member of the geosciences Graduate Faculty. In such a case, a geosciences program family member serves as the academic adviser.

Master's degree students are required to take a minimum of 30 credits at the 400, 500, 600, and 800 level, including at least 18 credits at the 500 to 600 level combined, and a minimum of 6 credits of thesis research (GEO SC 600 or GEO SC 610). The 12 to 16 common degree credits described below satisfy the Graduate School minimum of at least 12 credits in course work in the major program.

As part of the M.S. program, each student is required to complete a thesis. The thesis must be defended in an oral examination administered by an M.S. committee. The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School.

All graduate students in geosciences are expected to acquire breadth of knowledge in the geosciences, a fundamental and advanced knowledge of their subdiscipline, and skills in the areas of data collection and quantitative analysis. Toward that end, all graduate students must select one of the approved courses in each of the following areas:

1. Geosciences Breadth – 3-4 credits
2. Disciplinary Fundamentals – 3-4 credits
3. Data Gathering – 3-4 credits
4. Quantitative Analysis – 3-4 credits

Code	Title	Credits
Required Courses		
GEO SC 500	Issues in Geosciences	3
<i>Disciplinary Fundamentals</i>		
Select 3-4 credits from the following:		3-4
GEO SC 488	An Introduction to Seismology	
GEO SC 489	Dynamics of the Earth	
GEO SC 502	Evolution of the Biosphere	
GEO SC 518		
GEO SC 519	Mineral Equilibria	
GEO SC 533	Principles of Geochemistry	
GEO SC 542	Quantitative Methods in Hydrogeology	
GEO SC 548	Surface Processes	
GEO SC 585	Sedimentary Geology	
<i>Data Gathering and Interpretation</i>		
Select 3-4 credits from the following:		3-4
GEO SC 410	Marine Biogeochemistry	

GEO SC 413W	Techniques in Environmental Geochemistry	
GEO SC 483	Environmental Geophysics	
GEO SC 508	Mechanics of Earthquakes and Faulting	
GEO SC 558	Multi-channel Seismic Processing and Interpretation	
GEO SC 565	Tectonic Geomorphology	
GEO SC 572	Field Stratigraphy	
<i>Quantitative Analysis</i>		
Select 3-4 credits from the following:		3-4
EMCH 524A	Mathematical Methods in Engineering	
GEO SC 514	Data Inversion in the Earth Sciences	
GEO SC 560	Kinetics of Geological Processes	
GEO SC 561	Mathematical Modeling in the Geosciences	
PNG 425	Principles of Well Testing and Evaluation	
Electives		12
Culminating Experience		
GEO SC 600	Thesis Research	6
	or GEO SC 610 Thesis Research Off Campus	
Total Credits		30

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Upon arrival, students will be advised initially by a committee appointed by the associate head for graduate program and research. The committee in turn will designate an interim adviser. Before the end of the first academic year of residence, the student is expected to develop specific academic and research interests so that an appropriate permanent academic adviser and research supervisor may be chosen. The academic adviser and research supervisor are usually the same person, except when the research supervisor is not a member of the geosciences Graduate Faculty. In such a case, a geosciences program faculty member serves as the academic adviser.

Continuation in the Ph.D. program is determined by an oral qualifying examination before a qualifying examination committee. Preparation and defense of two research proposals will serve as one means of assessing the student's ability. At least one of these proposals should represent original work by the student, but the other may be an actual dissertation proposal and involve limited initial input from the adviser or others.

Course work in addition to the degree requirements described below will be selected by the student in consultation with his/her committee.

The comprehensive examination is both oral and written. It is administered by the Ph.D. committee after the student has essentially completed course work. To earn the Ph.D. degree, doctoral students must also write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School. A final oral defense of the dissertation is required.

All graduate students in geosciences are expected to acquire breadth of knowledge in the geosciences, a fundamental and advanced knowledge of their subdiscipline, and skills in the areas of data collection and quantitative analysis. Toward that end, all graduate students must select one of the approved courses in each of the following areas:

1. Geosciences Breadth – 3-4 credits
2. Disciplinary Fundamentals – 3-4 credits
3. Data Gathering – 3-4 credits
4. Quantitative Analysis – 3-4 credits

Code	Title	Credits
Required Courses		
GEOSC 500	Issues in Geosciences	3
<i>Disciplinary Fundamentals</i>		
Select 3-4 credits from the following:		3-4
GEOSC 488	An Introduction to Seismology	
GEOSC 489	Dynamics of the Earth	
GEOSC 502	Evolution of the Biosphere	
GEOSC 518		
GEOSC 519	Mineral Equilibria	
GEOSC 533	Principles of Geochemistry	
GEOSC 542	Quantitative Methods in Hydrogeology	
GEOSC 548	Surface Processes	
GEOSC 585	Sedimentary Geology	
<i>Data Gathering and Interpretation</i>		
Select 3-4 credits from the following:		3-4
GEOSC 410	Marine Biogeochemistry	
GEOSC 413W	Techniques in Environmental Geochemistry	
GEOSC 483	Environmental Geophysics	
GEOSC 508	Mechanics of Earthquakes and Faulting	
GEOSC 558	Multi-channel Seismic Processing and Interpretation	
GEOSC 565	Tectonic Geomorphology	
GEOSC 572	Field Stratigraphy	
<i>Quantitative Analysis</i>		
Select 3-4 credits from the following:		3-4
EMCH 524A	Mathematical Methods in Engineering	
GEOSC 514	Data Inversion in the Earth Sciences	
GEOSC 560	Kinetics of Geological Processes	
GEOSC 561	Mathematical Modeling in the Geosciences	
PNG 425	Principles of Well Testing and Evaluation	

Dual-Titles

Dual-title Ph.D. in Geosciences and Astrobiology

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Students must apply and be admitted to the graduate program in Geosciences and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Astrobiology dual-title program. Refer to the Admission Requirements section of the Astrobiology Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/astrobiology/>). Doctoral students must be admitted into the dual-title degree program in Astrobiology no later than the end of the fourth semester (not counting summer semesters) of entry into the graduate major program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Geosciences, listed in the Degree Requirements section. In addition, students must complete the degree requirements for the dual-title in Astrobiology, listed on the Astrobiology Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/astrobiology/>).

The Qualifying Examination in the major area alone will satisfy the Qualifying Exam requirement for the dual-title program.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Geosciences and Astrobiology dual-title Ph.D. student must include at least one member of the Astrobiology Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Astrobiology, the member of the committee representing Astrobiology must be appointed as co-chair. The Astrobiology representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Geosciences and Astrobiology. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-title Ph.D. in Geosciences and Biogeochemistry

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Graduate students with research and educational interests in biogeochemistry may apply to the Biogeochemistry Dual-Title Degree Program. Students must apply and be admitted to the graduate program in Geosciences and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Biogeochemistry dual-title program. Refer to the Admission Requirements section of the Biogeochemistry Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/biogeochemistry/>). Doctoral students must be admitted into the dual-title degree program in Biogeochemistry prior to taking the qualifying examination in their primary graduate program. Students in the Biogeochemistry Dual Title program are required to have two advisers from separate disciplines: one individual serving as a primary adviser in their major degree program and a secondary adviser in an area within a field covered by the dual-title program and a member of the Biogeochemistry faculty.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Geosciences, listed in the Degree Requirements section. In addition, students must complete the degree requirements for the dual-title in Biogeochemistry, listed on

the Biogeochemistry Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/biogeochemistry/>). Additional course work from an approved list of courses is required.

All students must pass a qualifying examination that includes an assessment of their potential in the field of biogeochemistry. A single qualifying examination that includes biogeochemistry will be administered for admission into the student's Ph.D. program, as well as the Biogeochemistry dual-title. The structure and timing of this exam will be determined jointly by the dual-title and major program. The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Geosciences and must include at least one Graduate Faculty member from the Biogeochemistry program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Geosciences and Biogeochemistry dual-title Ph.D. student must include at least one member of the Biogeochemistry Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Biogeochemistry, the member of the committee representing Biogeochemistry must be appointed as co-chair. The Biogeochemistry representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Geosciences and Biogeochemistry. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title Ph.D. in Geosciences and Climate Science

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

The dual-title in Geosciences and Climate Science is a Ph.D.-only degree.

Climate Science (<https://bulletins.psu.edu/graduate/programs/majors/climate-science/>) is a field devoted to the study of Earth's climate in the past, present, and future. A particular focus is understanding the effects of human activities (anthropogenic impacts) and natural forcing on climate. The Climate Science dual-title degree program is administered by the Department of Meteorology and Atmospheric Science for the participating graduate programs. The dual-title degree program is offered through participating programs in the College of Earth and Mineral Sciences and, where appropriate, other graduate programs in the University. The program enables students from several graduate programs to gain the perspectives, techniques, and methodologies of Climate Science, while maintaining a close association with major program areas of application.

Admission Requirements

Students must be admitted to Geosciences and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Climate Science dual-title program. Refer to the Admission Requirements section of the Climate Science Bulletin page (<https://bulletins.psu.eduhttps://bulletins.psu.edu/graduate/programs/majors/climatescience/>). Students must be admitted into the dual-title degree program in Climate Science no later than the end of the fourth semester (not counting summer semesters) of entry into the primary Ph.D. program and before taking the comprehensive exam.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the requirements of the Geosciences graduate program. In addition, they must satisfy the degree requirements for the dual-title in Climate Science, listed on the Climate Science Bulletin page (<https://bulletins.psu.eduhttps://bulletins.psu.edu/graduate/programs/majors/climatescience/>).

The qualifying examination in Geosciences satisfies the qualifying exam requirement for the dual-title degree program in Climate Science. In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>), the Ph.D. committee of a Climate Science dual-title doctoral degree student must include at least one member of the Climate Science Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Climate Science, the member of the committee representing Climate Science must be appointed as co-chair. The Climate Science representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in both Geosciences and Climate Science. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the Geosciences graduate program, and the Graduate School.

Dual-title Ph.D. and M.S. in Geosciences and Operations Research

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Students must apply and be admitted to the graduate program in Geosciences and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Operations Research dual-title program. Refer to the Admission Requirements section of the Operations Research Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>). Doctoral students must be admitted into the dual-

title degree program in Operations Research prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Geosciences, listed in the Degree Requirements section. In addition, students must complete the degree requirements for the dual-title in Operations Research, listed on the Operations Research Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Geosciences and must include at least one Graduate Faculty member from the Operations Research program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Geosciences and Operations Research. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Geosciences and Operations Research dual-title Ph.D. student must include at least one member of the Operations Research Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Operations Research, the member of the committee representing Operations Research must be appointed as co-chair. The Operations Research representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Geosciences and Operations Research. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Integrated Undergrad-Grad Programs

Integrated B.S. in Geosciences and M.S. in Geosciences

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Geosciences with the M.S. in Geosciences offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- University Park

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/>

[gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/](#)).

The Department of Geosciences offers an integrated B.S./MS. Program that is designed to allow academically superior students to obtain both the B.S. and the M.S. degree in Geosciences within 5 years of study. Students who wish to complete the Integrated B.S./M.S. Program in Geosciences must apply for admission to the Graduate School and the Integrated B.S./M.S. program by the end of their junior year

During the first three years, the student follows the course scheduling of one of the options in Geosciences (see the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>)); however, if a student intends to enter the Integrated B.S./M.S. program, he/she would be encouraged to take, wherever appropriate, upper level classes. By the end of the junior year, the student normally would apply for admission to the program. A decision of acceptance would be made prior to the beginning of the senior year and a M.S. Advising Committee would be appointed. During the senior year, the student would follow the scheduling of the B.S. Geosciences option he/she has selected, with an emphasis on completing 500-level course work wherever appropriate. During the senior year, the student will start work on a thesis designed to meet the departmental requirements of a M.S. thesis. During the fifth year, the student will take courses fulfilling the departmental M.S. degree requirements and complete the M.S. thesis.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students who wish to complete the Integrated B.S./M.S. Program in Geosciences must apply for admission via the Graduate School application for admission (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet all the admission requirements of the Graduate School and the Geosciences graduate program for the Master of Science degree, listed in the Admission Requirements section, by the end of their junior year. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. Three letters of recommendation by faculty members for admission to graduate studies are required. The applications are reviewed by the Admissions Committee of the Geosciences Graduate Program and acted upon by the Associate Head for Graduate Programs.

In consultation with an adviser, students must prepare a plan of study appropriate to this integrated program and must present their plan of study to the head of the graduate program or the appropriate committee overseeing the integrated program prior to being admitted to the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.

Degree Requirements

Students must fulfill all degree requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Science in Geosciences are listed in the Undergraduate Bulletin (<http://>

bulletins.psu.edu/undergraduate/). Degree requirements for the Master of Science in Geosciences degree are listed on the Degree Requirements tab. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.S. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
GEOSC 500	Issues in Geosciences	3
GEOSC 502	Evolution of the Biosphere	3
GEOSC 518		
GEOSC 521	Thermal State of the Earth	2-3
GEOSC 548	Surface Processes	3
GEOSC 558	Multi-channel Seismic Processing and Interpretation	4
GEOSC 561	Mathematical Modeling in the Geosciences	4
GEOSC 572	Field Stratigraphy	1-2

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course

load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

In addition, several graduate fellowships are available for students within the Department of Geosciences.

Programs of study are planned to require no more than two years for the M.S. degree and three additional years, or five years total, for the Ph.D. degree. A student transferring to the department with the M.S. degree should plan on four additional years. Financial support from teaching or research assistantships or from fellowships is available to students in good standing, but not awarded beyond these limits except in unusual cases.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Geosciences (GEOSC) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/geosc/>)

Learning Outcomes

Master of Science (M.S.)

1. **KNOW:** Students will develop and demonstrate advanced knowledge of a sub-specialty of geosciences, including understanding of, for example, historical and cutting-edge concepts, approaches, and techniques used in the field.
2. **ANALYZE & CREATE:** Students will demonstrate the ability to contextualize the results of data collection and analysis.
3. **RESEARCH IMPLEMENTATION:** Students will demonstrate the ability to develop and implement scientific approaches, utilizing data collection, analysis, or numerical models, to address a question or hypothesis
4. **COMMUNICATE:** Students will develop the ability to communicate their research findings to an audience of their peers in both written and oral form.
5. **QUANTIFY:** Students will develop the ability to incorporate quantitative analysis of data to support interpretations.
6. **CRITICAL THINKING:** Graduates will be able to critically analyze and assess work by others in their field of specialty.
7. **PROFESSIONAL PRACTICE:** Students will demonstrate knowledge of ethical standards in research and scholarship, and the ability to collaborate in a collegial and ethical manner with other professionals within their field or with diverse scientific backgrounds.

Doctor of Philosophy (Ph.D.)

1. **KNOW:** Students will develop and demonstrate advanced knowledge of a sub-specialty of geosciences, including understanding of, for example, historical and cutting-edge concepts, approaches, and techniques used in the field.
2. **ANALYZE & CREATE:** Students will demonstrate the ability to independently conceive a research hypothesis or question, and to contextualize the results of data collection and analysis.

3. **RESEARCH IMPLEMENTATION:** Students will demonstrate the ability to develop and implement scientific approaches, utilizing data collection, analysis, or numerical models, to address a question or hypothesis.
4. **COMMUNICATE:** Students will develop the ability to communicate their research findings to an audience of their peers in both written and oral form.
5. **QUANTIFY:** Students will develop the ability to incorporate quantitative analysis of data to support interpretations.
6. **CRITICAL THINKING:** Graduates will be able to critically analyze and assess work by others in their field of specialty.
7. **PROFESSIONAL PRACTICE:** Students will demonstrate knowledge of ethical standards in research and scholarship, and the ability to collaborate in a collegial and ethical manner with other professionals within their field or with diverse scientific backgrounds.

Contact

Campus	University Park
Graduate Program Head	Donald Myron Fisher
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Donald Myron Fisher
Program Contact	Jennifer Joy Houser 116 Deike Building University Park PA 16802 jjh2@psu.edu (814) 865-7791
Program Website	View (http://www.geosc.psu.edu/)

German

Graduate Program Head	Carrie Jackson
Program Code	GER
Campus(es)	University Park (Ph.D., M.A.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Art (M.A.) Dual-Title Ph.D. in German and Language Science Dual-Title Ph.D. in German and Visual Studies
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=GER)

Programs of study with major emphasis upon literature, linguistics, applied linguistics, or visual studies lead to advanced degrees.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Minimum qualifications for admission include 30 undergraduate credits in German beyond the intermediate level. Provision is made, however, for provisional admission (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/provisional-admission/>) with limited deficiencies. Students with a 3.00 junior/senior average (on a 4.00 scale) and with appropriate course backgrounds will be considered

for admission. The best-qualified applicants will be accepted up to the number of spaces that are available for new students. Exceptions to the minimum 3.00 grade-point average may be made for students with special backgrounds, abilities, and interests.

Degree Requirements

Master of ARTs (M.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The M.A. in German is designed to offer students a general foundation in German culture, language, linguistics, and literature. After completing a small set of core requirements, students may pursue their individual interests from among the courses offered by faculty who specialize in German Applied Linguistics, Culture, Linguistics, and Literature. The M.A. degree requires a minimum of 36 credits, with at least 18 at the 500 level, and is designed as a terminal degree.

The following courses are required for the M.A. degree:

Code	Title	Credits
Required Courses		
GER 510	Literary Theory: An Introduction	3
GER 511	The Teaching of College German	3
Select one of the following:		3
GER 513	German Phonetics and Phonology	
GER 514	German Syntax	
GER 515		
Total Credits		9

Practical experience in supervised teaching is required for all graduate degrees. Students who wish to earn a master's degree must enroll in GER 596 and write a scholarly research paper of between thirty and fifty pages on a topic defined in conjunction with a faculty adviser. The research paper should demonstrate mastery of primary and secondary literature, interpretative skills, and academic prose in both German and English. A one-hour oral defense of the paper shall be scheduled two weeks after its formal submission to the adviser. A committee consisting of faculty adviser and two other members of the German program selected by the M.A. candidate shall evaluate the student's knowledge of the subject matter.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

For the Ph.D., a student must complete at least 54 credits (these can include M.A. credits) of graduate-level work. The following courses are required of all students:

Code	Title	Credits
Required Courses		
GER 510	Literary Theory: An Introduction	3
GER 511	The Teaching of College German	3
Select one of the following:		3
GER 513	German Phonetics and Phonology	
GER 514	German Syntax	

GER 515

Total Credits**9**

Other requirements include:

1. demonstrated reading knowledge of one foreign language in addition to German and English,
2. successful passing of the comprehensive examination with written and oral components, and
3. completed doctoral dissertation and passing a final oral examination (the dissertation defense). The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

- 1.

Dual-Titles

Dual-Title Ph.D. in German and Language Science

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Graduate students with research and educational interests in German and Language Science may apply to the dual-title Ph.D. in German and Language Science. The goal of the dual-title degree in German and Language Science is to enable graduate students from German to acquire the knowledge and skills of their major area of specialization in German, while at the same time gaining the perspective and methods of the Language Science.

Admission Requirements

Students must apply and be admitted to the graduate program in German and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission and meet the admissions requirements of the Language Science dual-title program. Refer to the Admission Requirements of the Language Science Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/language-science/>). Doctoral Students must be admitted into the dual-title degree program in Language Science prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the Ph.D. degree requirements in German. In addition, students must complete the degree requirements for the dual-title in Language Science, listed on the Language Science Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/language-science/>).

Some courses may satisfy both German and Language Science degree requirements. Final course selection must be approved by the student's Ph.D. committee. Students who hold a master's degree from another institution may petition to have equivalent course credits accepted.

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from German and must include at least one Graduate Faculty member from the Language Science program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both German and Language Science. Dual-title graduate degree students may require an additional

semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a German and Language Science dual-title Ph.D. student must include at least one member of the Language Science Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Language Science, the member of the committee representing Language Science must be appointed as co-chair. The Language Science representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in German and Language Science. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School

Dual-Title Ph.D. in German and Visual Studies

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Graduate students with interests in German culture and the history of visual media may apply to the dual-title Ph. D. in German and Visual Studies. The goal of the dual-title Ph.D. in German and Visual Studies is to enable graduate students from German to acquire the knowledge and skills of their major area of specialization in German, while at the same time gaining the theories and methods of Visual Studies.

Admission Requirements

Students must apply and be admitted to the graduate program in German and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Visual Studies dual-title program. Refer to the Admission Requirements section of the Visual Studies Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/visual-studies/>). Students must receive approval from the Director of Graduate Studies in German, and must submit a recommendation from a member of the German Graduate Faculty who is also a member of the Visual Studies Graduate Faculty. Doctoral students must be admitted into the dual-title degree program in Visual Studies prior to taking the qualifying examination in German.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the Ph.D. degree in German. In addition, students must complete the degree requirements for the dual-title in Visual Studies, listed on the Visual Studies Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/visual-studies/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from German and must include at least one Graduate Faculty member from the Visual Studies program.

Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both German and Visual Studies. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a German and Visual Studies dual-title Ph.D. student must include at least one member of the Visual Studies Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Visual Studies, the member of the committee representing Visual Studies must be appointed as co-chair. The Visual Studies representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in German and Visual Studies. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

In addition, the following awards typically have been available to graduate students in this program.

Exchange Fellowships at Christian Albrechts Universität, Kiel, and the Phillips Universität, Marburg

Available to graduate students in German and other fields for a full academic year. Students must have a good command of German.

Walter Edwin Thompson and Dr. Regina Block Thompson Scholarship Fund

Thompson Fellowships are available each year for graduate students in the Department of Germanic and Slavic Literatures and Languages. These fellowships can be awarded in addition to other grants or stipends.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

German (GER) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/ger/>)

Learning Outcomes

Ph.D. graduates in German literature and culture or in German linguistics and applied linguistics will be able to:

1. KNOWLEDGE: Demonstrate knowledge of appropriate critical and theoretical vocabularies and perspectives about reading and writing so that they can become part of the ongoing national and international discussion central to German literature and culture or to German linguistics and applied linguistics.
2. CRITICAL THINKING: Demonstrate the ability to critique, edit, and revise written texts, whether their own or their students'.
3. COMMUNICATION: Demonstrate mastery of the conventions of writing a paper suitable for presentation at a professional conference.
4. RESEARCH/CREATE: Design a dissertation on a topic that reflects their original research and education in German literature and culture or in German linguistics and applied linguistics.
5. TEACH: Refine a variety of strategies and methodologies to help improve the reading and writing of students and to teach College German.

Contact

Campus	University Park
Graduate Program Head	Carrie Neal Jackson
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Samuel Mark Frederick
Program Contact	William Whitesmith 442 Burrowes Bldg University Park PA 16802 wmw5235@psu.edu (814) 863-3522
Program Website	View (http://german.la.psu.edu/german/graduate/)

Health Administration

Graduate Program Head	L. Marvin Overby
Program Code	HADM
Campus(es)	Harrisburg (M.H.A.)
Degrees Conferred	Master of Health Administration (M.H.A.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=HADM)

Healthcare has become one of the top three industries in the United States. As it has expanded, the practice of healthcare administration has become much more complex. Recognizing that the national healthcare system is in a period of administrative and technical restructuring and redesign, healthcare leadership is looking to its staff to meet the new challenges confronting its healthcare system. With the scope and depth of the restructuring, it will require many staff to “retool” to meet the challenges.

The Master of Healthcare Administration Program at Penn State, Harrisburg, is specifically designed to aid healthcare staff in gaining the skills needed to meet the new complexity of the healthcare system. The Program is designed to ensure that its Graduates will be fully capable of identifying and resolving new, complex healthcare system issues and seizing on latent opportunities stemming from its growth and complexity. The 36-credit curriculum initially reviews core foundational healthcare administrative and system issues. It then covers more advanced healthcare program components, with an emphasis on currency in practice. Currency of practice in the field is focused on with the intent of elevating staff knowledge, skills, and abilities that will allow them to meet the complexities and challenges of a rapidly growing and changing healthcare system.

The degree is designed for part-time, working students already engaged in healthcare administration careers. The mission of the program is to enhance student knowledge and skills in a continuous learning cycle so that they will be prepared to address today’s healthcare system challenges. There is an expectation that students will possess a basic knowledge of existing healthcare administrative practice and be capable of developing skills to redesign and implement innovative internal systems consistent with the demands of their unit and the needs of the overall system to which they are assigned. This would include but not be limited to one or more than one of the following: issues of access to care, efficient and effective management, cost control, and quality of care delivery.

Part-time students may start the program at the beginning of any semester. Students usually take one or two 3-credit courses each semester depending on a student’s available time and their desire to finish. Students may also take up to 6 credits during a summer session to maintain steady progress toward the degree. All Healthcare Administration courses are scheduled for the evening hours for the convenience of part-time students. A student generally completes the MHA on a part-time basis in two to four years.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Undergraduate degrees in any major are acceptable for admission. Applicants who are still completing their baccalaureate requirements at the time of the application may be provisionally admitted (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/provisional-admission/>) to the Graduate School conditional on the awarding of the baccalaureate degree.

Admission to the M.H.A program is based on clear suitability for the M.H.A. program as demonstrated by the application as a whole, to include:

- a completed online Graduate School application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) and payment of the nonrefundable application fee,
- evidence of a bachelor’s degree from a regionally accredited college as outlined in the link above;
- a statement of career and educational goals;
- a successful undergraduate record with a minimum grade-point average of 3.00 (with particular attention given to the last two years of undergraduate work);
 - satisfactory scores on the Graduate Record Examination (GRE) or Graduate Management Admission Test (GMAT) are required if the GPA is less than 3.00 (typically, applicants who have scores of 1,000 or higher on the GRE and are admitted to the program tend to be successful in the program);
- three years of work experience; and
- names of three references willing to provide recommendations.

The GPA requirement may be relaxed if the student has professional experience or other strong evidence suggesting likely success in the M.H.A. program. Some applicants may be admitted on a provisional basis (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/provisional-admission/>); the condition for removal of provisional status is obtaining a grade-point average of 3.00 in 15 credits of approved courses within two semesters.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of Health Administration (M.H.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The degree requires a total of 36 credits, with a minimum of 33 credits at the 500-level, including a 3-credit culminating experience (faculty-supervised paper); up to 3 credits of 400-level work may be included in the electives. An overall 3.00 (B) grade-point average must be earned in all course work.

Code	Title	Credits
Required Courses		
HADM 539	Health Systems Organization	3
HADM 540	Health Administrative Policy Formulation	3
HADM 541	Health Economics and Policy	3

HADM 542	Health Care Politics and Policy	3
HADM 545	Health Financial Management	3
PADM 503	Research Design	3
PADM 506	Public Information Management and Technology	3
PADM 510	Organization Behavior	3
Electives		
Select 9 credits of the following:		9
HADM 543	Long-Term Care Administration and Policy	
HADM 546	Health Planning for Public Administration	
HADM 548	Health Care Quality Assurance	
HADM 551	Health Care Law	
HADM 552	Health Delivery Systems	
HADM 597	Special Topics	
PADM 505	Human Resources in the Public and Nonprofit Sectors	
PADM 511	Organizational Change and Development	
PADM 512	Issues in Human Resources	
PADM 514		
PADM 515	Labor Management Relations	
PADM 516	Strategic Planning	
Culminating Experience		
HADM 594	Research Topics (Faculty-supervised paper)	3
Total Credits		36

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Health Administration (HADM) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/hadm/>)

Learning Outcomes

1. Communication and Relationship Management
2. Leadership
3. Professionalism
4. Knowledge of the Health Care Environment
5. Business Skills and Knowledge

Contact

Campus	Harrisburg
Graduate Program Head	L. Marvin Overby
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Elizabeth Jane Beckett-Camarata
Program Contact	Melissa D Forkey School of Public Affairs 777 West Harrisburg Pike, 159W Olmsted Bldg. Middletown PA 17057 mpf5451@psu.edu (717) 948-6322
Program Website	View (https://harrisburg.psu.edu/public-affairs/health-administration/master-health-administration/)

Health Policy and Administration

Graduate Program Head	Christopher Hollenbeak
Program Code	HPA
Campus(es)	University Park (Ph.D., M.S., M.H.A.) World Campus (M.H.A.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Master of Health Administration (M.H.A.) Dual-Title Ph.D. and M.S. in Health Policy and Administration and Demography Integrated B.S. in Health Policy and Administration and M.H.A. in Health Policy and Administration Joint J.D./M.H.A. with Penn State Law
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=HPA)

The graduate degrees in the Department of Health Policy and Administration focus on management, policy, and research in health services, with particular attention to the recurrent problems of cost, quality, and access to health services.

The doctoral program (Ph.D.) is designed to provide advanced knowledge and skills in health services research, with an emphasis track in health policy and economics, health care organizations or population health and demography. The doctorate in HPA prepares students to become independent health services researchers in academic and nonacademic settings.

The Master of Science (M.S.) degree in Health Policy and Administration provides a solid foundation of knowledge and skills in health services research. The M.S. in HPA prepares students for further graduate study toward a doctorate in health services research or related fields or for research and analytic work in academic and nonacademic health services research settings.

The professional Master of Health Administration (M.H.A.) program prepares students for the complexities they will face in managing organizations that plan, finance and deliver health care. The curriculum emphasizes strategic decision-making, financial management, communication and detailed aspects of the U.S. health care system. These include health law, epidemiology, health insurance, government health-financing programs, ethics, managed care, long-term care, health care technology, marketing, and strategic planning for health services.

The integrated B.S. in Health Policy and Administration and Master of Health Administration (M.H.A.) program allows qualified undergraduate students to earn both degrees in five calendar years of full time academic study. Students completing an integrated B.S./M.H.A. are prepared to advance quickly to positions of leadership in health care organizations.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

M.H.A.

GRE scores are not required for admission. A junior/senior grade-point average of 3.00 or better (on a 4.00 scale), a relevant personal statement and three letters of recommendation are necessary. Some work experience in health care is preferred, but not required.

M.S. and Ph.D.

Satisfactory scores from either the Graduate Management Admission Test (GMAT) or the Graduate Record Examination (GRE) are required for admission; the GRE is preferred. A junior/senior grade-point average of 3.00 or better (on a 4.00 scale) and a well-considered statement of experience and career goals are major criteria for admission. Some work experience in health services is preferred, but not required.

Degree Requirements

Master of Health Administration (M.H.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The program can be completed on a full-time basis in 21 months or on a part-time basis or with the aid of technology through the World Campus in 28 months. Requirements for the completion of the M.H.A. include 49 credits with at least 39 credits at the 500-or 800-level. Included in the 49 credits is a residency in a health care setting and a capstone course to demonstrate evidence of analytical ability and synthesis of material.

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The M.S. curriculum in HPA includes study in three substantive areas:

1. a core set of courses in health services organization, delivery, finance, and policy;
2. courses in health services research methods and statistics, and
3. courses and a master's thesis approved by the thesis advisor.

At least 15 credits of the program must be completed in HPA departmental course offerings at the 400-and 500-level. At least 18 credits of the degree must be in 500-and 600-level courses. A 6-credits master's thesis must be completed as part of the degree requirement.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The HPA doctoral curriculum includes study in three substantive areas:

1. core courses in health services organization, delivery, finance and policy;
2. core courses in health services research methods and statistics, and
3. courses and a doctoral dissertation in an emphasis track approved by the Ph.D. committee.

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Dual-Titles

Dual-Title M.S. and Ph.D. in Health Policy and Administration and Demography

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Students must apply and be admitted to the graduate program in Health Policy and Administration and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Demography dual-title program. Refer to the Admission Requirements section of the Demography Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/demography/>). Doctoral students must be admitted into the dual-title degree program in Demography prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Health Policy and

Administration, listed in the Degree Requirements section. In addition, students must complete the degree requirements for the dual-title in Demography, listed on the Demography Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/demography/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Health Policy and Administration and must include at least one Graduate Faculty member from the Demography program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Health Policy and Administration and Demography. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Health Policy and Administration and Demography dual-title Ph.D. student must include at least one member of the Demography Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Demography, the member of the committee representing Demography must be appointed as co-chair. The Demography representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Health Policy and Administration and Demography. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Integrated Undergrad-Grad Programs

Integrated B.S. in Health Policy and Administration and M.H.A. in Health Policy and Administration

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Health Policy and Administration with the M.H.A. in Health Policy and Administration offered at the following campuses:

Undergraduate Degree

- Beaver
- Harrisburg
- Hazleton
- Lehigh Valley
- Mont Alto
- Schuylkill
- Shenago
- University Park

- World Campus

Graduate Degree

- University Park
- World Campus

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The following credentials will be considered for admission:

- A demonstrated ability to communicate effectively, an advanced level of maturity, and high motivation to pursue a career in the health care field
- Academic references
- Successful completion of 60 undergraduate credits having maintained a cumulative GPA of 3.4 or better

Students must apply to the program via the Graduate School application for admission (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet all the admission requirements of the Graduate School and the Health Policy and Administration graduate program for the Master of Health Administration degree, listed in the Admission Requirements section. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.

In consultation with an adviser, students must prepare a plan of study appropriate to this integrated program, and must present their plan of study to the head of the graduate program or the appropriate committee overseeing the integrated program prior to being admitted to the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.

Degree Requirements

Students admitted to the B.S. in Health Policy and Administration/M.H.A. are able to earn both the B.S. and M.H.A. in five calendar years of full-time academic study.

Students must fulfill all degree requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Science in Health Policy and Administration are listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>). Degree requirements for the Master of Health Administration in Health Policy and Administration degree are listed on the Degree Requirements tab. Students must sequence their

courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.S. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Up to 15 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Joint Degrees

Joint J.D./M.H.A. with Penn State Law

Requirements listed here are in addition to requirements listed in GCAC-211 Joint Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-211-joint-degree-programs/>).

Penn State Law (University Park) and Health Policy and Administration (HPA) offer coordinated programs of studies leading to the degrees of Juris Doctor (J.D.) and Master of Health Administration (M.H.A.).

Admission Requirements

Students applying to the joint degree program must be admitted separately into both Penn State Law and HPA. Students must first be admitted to the law school and must complete the required first-year curriculum in the J.D. program before commencing the M.H.A. component. Admissions requirements and applications for admission for Penn State Law are listed in the J.D. Admissions (<https://pennstatelaw.psu.edu/penn-state-law-jd-admissions/>) section of the Penn State Law website. The admission requirements for the Health Policy and Administration graduate program are listed on the Admission Requirements tab. Application to the MHA program must take place through the Graduate School Application. Formal admission to the M.H.A. program would normally take place during the student's first year of law, but HPA may extend provisional admission to the M.H.A. program at the time an applicant applies to Penn State Law particularly where an applicant's law school choice depends upon admission to the J.D./M.H.A. joint degree program. At the student's request, the LSAT may replace the GRE for joint degree admissions purposes. International applicants to the joint degree program who do not qualify for the TOEFL exemption must have a minimum TOEFL score of 88 on the internet-based test (with a minimum speaking score of 20), or a minimum of 575 on the paper test; a minimum of 6.5 on the IELTS will also be acceptable.

Residency

Students in the program will spend six semesters in Penn State Law and two to three semesters in HPA.

Liaisons

The director of the HPA M.H.A. program and the Penn State Law Associate Dean for Academic Affairs are designated program advisors and liaisons between the programs. Students will need to work with these designated program advisors and their individual faculty advisors from both programs to build an individual program.

Inter Program Transfer of Credits

Courses cannot be transferred or shared until the applicant is officially admitted to the joint program. Retroactive transfers of courses taken prior to admission to the joint program are not permitted.

Penn State Law

Penn State Law will accept the transfer of twelve (12) credits from the M.H.A. program's required core curriculum as elective credit towards the J.D. Students must obtain a grade satisfactory to the program in order for the credits to be transferable.

Health Policy and Administration

HPA will accept the transfer of twelve (12) credits from the Penn State Law curriculum towards the M.H.A. in lieu of:

1. two M.H.A. electives,
2. a required M.H.A. course in health law, and
3. one other required M.H.A. course as determined by the student and their advisors.

Specific law course selection for transfer to the M.H.A. will be dependent on course offerings available at Penn State Law. Students must obtain a grade satisfactory to the program in order for the credits to be transferable.

Course Sequencing

Students enrolling in the joint degree may choose to conduct their study in either of two sequence options below. Each "Year" refers to the traditional academic year beginning in late August and concluding in May. In compliance with ABA Standards and Rules law students may not enroll for more than 17 credits per semester at Penn State.

Joint J.D./ M.H.A. Degree Program Option 1

Year 1

- J.D. Required First-Year Curriculum (32 crs)
- Summer Semester: HPA 595 - M.H.A. Residency Requirement. This requirement may be satisfied with a J.D. externship, as coordinated between Penn State Law and the M.H.A. program. (1-3 crs)*

Year 1 total credits is 32-35*

Year 2

- Fall Semester: HPA 503, HPA 447, HPA 520, HPA 523 (12 crs)
- Spring Semester: HPA 524, HPA 835, HPA 551, HPA 855 (12 crs)
- Summer Semester: HPA 595 - M.H.A. Residency Requirement, if not fulfilled between year one and two of program. This requirement may be satisfied with a J.D. externship, as coordinated between Penn State Law and the M.H.A. program. (1-3 crs)*

Year 2 total credits is 24-27*

Penn State Law does not have a required number of credits for the second and third year of the J.D. degree program. Students are required to complete 88 credits to earn the J.D. Twelve (12) credits is full-time. J.D. students may enroll in a maximum of 17 credits per semester. J.D. students will complete a minimum of 56 credits their second and third year.

Year 3

- Fall Semester: HPA 850, HPA 805, HPA 556, elective credits from J.D. Program (minimum 3), substitution credits for HPA 836 or HPA 556 (12 crs)

- Spring Semester: Capstone (3), HPA 545, elective credits from J.D. Program (minimum 3), substitution credits for HPA 836 or HPA 556 (12 crs)

Year 3 total credits is 24.

Penn State Law does not have a required number of credits for the second and third year of the J.D. degree program. Students are required to complete 88 credits to earn the J.D. Twelve (12) credits is full-time. J.D. students may enroll in a maximum of 17 credits per semester. J.D. students will complete a minimum of 56 credits their second and third year.

Year 4

- J.D. Upper Level Coursework: If not already satisfied, student must successfully complete Professional Responsibility (CORE 934) and the seminar requirement, both J.D. degree requirements at Penn State Law.

Penn State Law does not have a required number of credits for the second and third year of the J.D. degree program. Students are required to complete 88 credits to earn the J.D. Twelve (12) credits is full-time. J.D. students may enroll in a maximum of 17 credits per semester. J.D. students will complete a minimum of 56 credits their second and third year.

Total credits required for the J.D. degree is 88.

Total credits required for the M.H.A. degree is 49-51.*

*Variable credit totals depend on which year M.H.A. Summer Residency requirement is met and whether it is met with HPA 595 (1 cr) or J.D. externship (3crs).

Joint J.D./ M.H.A. Degree Program Option 2

Year 1

- J.D. Required First-Year Curriculum (32 crs)

Year 2

- J.D. Upper Level Coursework: Student should consider taking Professional Responsibility (CORE 934) and a seminar course, both J.D. degree requirements at Penn State Law.

Penn State Law does not have a required number of credits for the second and third year of the J.D. degree program. Students are required to complete 88 credits to earn the J.D. Twelve (12) credits is full-time. J.D. students may enroll in a maximum of 17 credits per semester. J.D. students will complete a minimum of 56 credits their second and third year.

Year 3

- Fall Semester: HPA 503, HPA 447, HPA 520, HPA 523 (12 crs)
- Spring Semester: HPA 524, HPA 835, HPA 551, HPA 855 (12 crs)
- Summer Semester: HPA 595 - M.H.A. Residency Requirement. This requirement may be satisfied with a J.D. externship, as coordinated between Penn State Law and the M.H.A. program. (1-3 crs)

Year 3 total credits is 25-27*

Penn State Law does not have a required number of credits for the second and third year of the J.D. degree program. Students are required to complete 88 credits to earn the J.D. Twelve (12) credits is full-time. J.D. students may enroll in a maximum of 17 credits per semester. J.D.

students will complete a minimum of 56 credits their second and third year.

Year 4

- Fall Semester: HPA 850, HPA 805, elective credits from J.D. Program (minimum 3), substitution credits for HPA 836 or HPA 556 (12 crs)
- Spring Semester: Capstone(3), HPA 545, elective credits from J.D. Program (minimum 3), substitution credits for HPA 836 or HPA 556 (12 crs)
- J.D. Upper Level Coursework: If not already satisfied, student must successfully complete Professional Responsibility (CORE 934) and the seminar requirement, both J.D. degree requirements at Penn State Law.

Total credits required for the J.D. degree is 88.

Total credits required for the M.H.A. degree is 49-51.*

*Variable credit totals depend on which year M.H.A. Summer Residency requirement is met and whether it is met with HPA 595 (1 cr) or J.D. externship (3crs)

Recommended Program of Study and Advising

The director of the HPA M.H.A. program and the Penn State Law Associate Dean for Academic Affairs are designated program advisors. In addition, students will have individual faculty advisors in both programs. Periodic interaction between the two advisors will be encouraged. A program of study will be developed for each student.

Tuition

Students will be charged the applicable Penn State Law tuition to cover the J.D. program and the applicable graduate tuition to cover the M.H.A. degree program. Penn State Law tuition will be paid for the semesters in which the student is registered for Penn State Law courses, and graduate tuition will be paid for the semesters in which the student is registered for graduate courses in the M.H.A. program. A student may take up to one course (3 credit hours) per semester in the program where the student is not primarily registered without any change in tuition, but must pay additional tuition to the program that the student is not primarily registered if he or she wishes to take additional course work pursuant to that program during the semester.

Financial Aid and Assistantships

Decisions on financial aid and assistantships will be made by each school according to that school's procedures. Students on graduate assistantships must adhere to the course load limits (<http://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Fulfillment of Degree Requirements and Graduation

A student in the program may complete the requirements for one of the degrees and be awarded that degree prior to completing all the requirements for the other degree; provided, however, that the student shall have successfully completed at least two semesters of work towards the other degree. All courses in one program that will count towards meeting the requirements of the other must be completed before the awarding of either degree. Students will be required to fulfill all requirements for each degree in order to be awarded that degree, subject to the inter-program transfer of credits.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated

in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Health Policy and Administration (HPA) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/hpa/>)

Learning Outcomes

Master of Health Administration (m.H.A.)

1. Graduates will demonstrate a thorough understanding of the financing, organization, and delivery of health services, along with appropriate research methods.
2. Graduates will master the current literature on health policy, health administration, and related topics.
3. Graduates will complete an independent research project that significantly furthers knowledge in the field.
4. Graduates will be able to effectively communicate arguments and ideas in oral presentations and written works.
5. Graduates will demonstrate knowledge of professional standards in health policy and administration.

Master of Science (M.S.)

1. **KNOW:** Define key conceptual, theoretical and empirical frameworks related to the field of health policy and administration.
2. **THINK:** Recognize and interpret seminal and current theoretical and empirical literature in the field of health policy and administration.

3. **THINK:** Describe and evaluate how analytical and empirical methods are used to answer research questions in the field of health policy and administration.
4. **APPLY/CREATE:** Assemble and summarize research related to a topic within the field of health policy and administration; propose a relevant and answerable research question and design a strategy to answer that question.
5. **APPLY/CREATE:** Formulate, plan and execute an independent research project culminating in a thesis that contributes to the body of knowledge in the field of health policy and administration.
6. **COMMUNICATE:** Describe and interpret the context, methods, results and conclusions of an independent research project in the form of a written thesis and oral defense.
7. **PROFESSIONAL PRACTICE:** Demonstrate knowledge of professional standards and research integrity in the field of health policy and administration.

Doctor of Philosophy (Ph.D.)

1. **KNOW:** Define and explain key conceptual, theoretical and empirical frameworks related to the field of health policy and administration broadly and in a specialized or interdisciplinary area.
2. **THINK:** Interpret, appraise and critique seminal and current theoretical and empirical literature in the field of health policy and administration broadly and in a specialized or interdisciplinary area.
3. **THINK:** Describe, differentiate, evaluate and apply analytical and empirical methods used to answer research questions in the field of health policy and administration broadly and in a specialized or interdisciplinary area.
4. **APPLY/CREATE:** Review and synthesize research related to one or more topics within a specialized field or interdisciplinary area of health policy and administration; identify areas within those topics where expanding the frontier of knowledge is valuable; propose a cohesive set of relevant and answerable research questions; design research strategies to answer those questions.
5. **APPLY/CREATE:** Formulate, plan and execute an independent research project culminating in a dissertation that significantly furthers knowledge in a specialized field or interdisciplinary area of health policy and administration.
6. **COMMUNICATE:** Motivate, describe, interpret, and evaluate the context, methods, results, and conclusions of an independent research project in a specialized field or interdisciplinary area of health policy and administration in the form of a written dissertation and oral defense.
7. **PROFESSIONAL PRACTICE:** Demonstrate knowledge of professional standards and research integrity in the field of health policy and administration broadly and in a specialized or interdisciplinary area.

Contact

Graduate Program Head: Christopher Hollenbeak

Ph.D. and M.S. Program Contacts

Director of Graduate Studies/Professor-in-Charge: David Vanness

Primary Program Contact: Ashlee Foreman

Email: anl5234@psu.edu (smr38@psu.edu)

Mailing Address: 604 Ford Building, University Park, PA 16802

Telephone: (814) 863-9971

Program Website: Ph.D. & M.S. at University Park (<http://hhd.psu.edu/hpa/graduate/phd-health-policy/>)

M.H.A. Program Contacts

Director of Graduate Studies/Professor-in-Charge: Christopher Calkins

Primary Program Contact: Aileen Galley

Email: ahs13@psu.edu

Mailing Address: 118 Keller Building, University Park, PA 16802

Telephone: (814) 863-4810

Program Website:

M.H.A. at University Park (<https://hhd.psu.edu/hpa/graduate/master-health-administration/>)

M.H.A. at World Campus (<http://www.worldcampus.psu.edu/degrees-and-certificates/health-policy-and-administration-masters/overview/>)

Higher Education

Graduate Program Head	Kevin Kinser
Program Code	HIED
Campus(es)	University Park (Ph.D., D.Ed., M.Ed.) World Campus (M.Ed.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Doctor of Education (D.Ed.) Master of Education (M.Ed.) Dual-Title Ph.D., D.Ed., and M.Ed. in Higher Education and Comparative and International Education Joint J.D./Ph.D., D.Ed., M.Ed. with Penn State Law
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=HIED)

The graduate program in Higher Education has as its goal the preparation of individuals who will pursue careers and exert leadership in postsecondary education as administrators, faculty, or researchers in the nation's colleges and universities and in a variety of public and private agencies and associations in the United States and other nations. With emphasis on the systematic study of higher education, the program builds on the scholarly and scientific disciplines offered throughout the University and applies these studies to the professional functions and responsibilities that its graduates will assume, and to the knowledge of the field of higher education.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

All applicants must submit a resume, a statement of purpose, and three letters of recommendation.

GRE scores are not required for admission.

Students in the D.Ed. and Ph.D. programs at University Park may begin the program in the fall semester. Students in the M.Ed. program at University Park may begin the program in the fall or spring semesters. Students in the M.Ed. program through World Campus may begin the program in the summer, fall, or spring semesters.

Degree Requirements

Master of Education (M.Ed.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

A minimum of 30 credits is required, and must include:

Code	Title	Credits
Required Courses		
HIED 808	Pro-Seminar in U.S. Higher Education	3
HIED 545	Foundations in Higher Education and Student Affairs	3
HIED 842	Administrative Leadership in Higher Education	3
HIED 846	College Students and Their Success	3
HIED 841	Research and Assessment in Student Affairs	3
or HIED 801	Foundations of Institutional Research	
<i>Emphasis Area in Higher Education</i>		
	Students will choose an emphasis area to tailor a program of study to fit an intended career path, in consultation with their adviser. A list of acceptable emphasis areas and their required courses is maintained by the program.	6
Electives		
	Students will choose from a list of approved electives maintained by the program office, in consultation with the student's adviser.	6
Culminating Experience		
HIED 596	Individual Studies ¹	3
Total Credits		30

¹ This course provides students the opportunity to demonstrate knowledge and skills that they have developed during the program in a culminating project that, in turn, may showcase their interests and abilities as they seek employment beyond graduation. In addition, students will self-assess their relative progress towards the intended learning outcomes of the program.

Doctor of Education (D.ED.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The D.Ed. requires a minimum of 90 credits, of which at least 30 credits must be earned in residence at the University Park campus. A maximum of 30 credits from a completed master's degree earned at an institution that does not grant a doctorate in Higher Education may be accepted towards this minimum, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>). A maximum of 60 credits beyond the baccalaureate may be accepted towards this minimum, subject to restrictions outlined in GCAC-309 Transfer Credit

(<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>).

Code	Title	Credits
Required Courses		
HIED 501	Foundations of Higher Education	3
HIED 502	Diversity & Equity in Higher Education	3
HIED 552	Administration and Organization in Higher Education	3
HIED 556	Higher Education Students and Clientele	3
<i>Specialization in Higher Education</i>		
Select 9 credits in additional HIED course work.		9
<i>Theoretical/Conceptual</i>		
Select 9 credits from list maintained by the graduate program office.		9
<i>Methodological</i>		
Select 12 credits, including at least (a) one quantitative course (e.g., STAT 500 or EDPSY 406) and (b) one qualitative course (e.g., HIED 586).		12
<i>Proposal</i>		
HIED 594	Research Topics (Research Proposal Topics)	3
Dissertation		
HIED 600	Thesis Research	15
or HIED 610	Thesis Research Off Campus	
Total Credits		60

In addition, the program may require a 9-credit internship depending on students' previous professional experiences in higher education administration. D.Ed. students must pass a qualifying examination, a comprehensive written and oral examination, and a final oral examination (the dissertation defense). Their dissertation must also be accepted by the doctoral committee, the head of the graduate program, and the Graduate School.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A minimum of 51 credits is required:

Code	Title	Credits
Required Courses		
HIED 501	Foundations of Higher Education	3
HIED 502	Diversity & Equity in Higher Education	3
HIED 552	Administration and Organization in Higher Education	3
HIED 556	Higher Education Students and Clientele	3
<i>Specialization in Higher Education</i>		
Select 9 credits of additional HIED course work		9
<i>Theoretical/Conceptual</i>		
Select 9 credits from a list maintained by the program office.		9
<i>Methodological</i>		
Select 18 credits, with at least (a) one quantitative course (e.g., STAT 500 or EDPSY 406) and (b) one qualitative course (e.g., HIED 586).		18
<i>Proposal</i>		

HIED 594	Research Topics (Research Proposal Topics)	3
Total Credits		51

Ph.D. students must pass a qualifying examination, a comprehensive written and oral examination, and a final oral examination (the dissertation defense). Their dissertation also must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Titles

Dual-Title M.Ed., D.Ed., and Ph.D. in Comparative and International Education

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Students must apply and be admitted to the graduate program in Higher Education and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Comparative and International Education dual-title program. Refer to the Admission Requirements section of the Comparative and International Education Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/comparative-international-education/>). Doctoral students must be admitted into the dual-title degree program in Comparative and International Education prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Higher Education. In addition, students must complete the degree requirements for the dual-title in Comparative and International Education, listed on the Comparative and International Education Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/comparative-international-education/>). Some courses may satisfy both Higher Education and Comparative and International Education degree requirements. Final course selection must be approved by the student's Ph.D. committee.

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Higher Education and must include at least one Graduate Faculty member from the Comparative and International Education program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Higher Education and Comparative and International Education. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Higher Education and Comparative and International Education dual-title Ph.D. student must include at least one member of the Comparative and International Education Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Comparative and International

Education, the member of the committee representing Comparative and International Education must be appointed as co-chair. The Comparative and International Education representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Higher Education and Comparative and International Education. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Joint Degrees

Joint J.D/M.Ed., D.Ed., and Ph.D. with Penn State Law

Requirements listed here are in addition to requirements listed in GCAC-211 Joint Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-211-joint-degree-programs/>).

Penn State Law (PSL) and the Higher Education (HIED) Program offer a joint degree program leading to a Juris Doctor (J.D.); and either a Master of Education (M.Ed.), a Doctor of Education (D.Ed.), or a Doctor of Philosophy (Ph.D.) in Higher Education.

Admission Requirements

Applicants to the joint degree program must apply and be admitted first to Penn State Law, and subsequently to the Higher Education graduate program. Admissions requirements and applications for admission for Penn State Law are listed in the J.D. Admissions (<https://pennstatelaw.psu.edu/penn-state-law-jd-admissions/>) section of the Penn State Law website. The admission requirements for the Higher Education graduate program are listed on the Admission Requirements tab. When applying to the Higher Education graduate program, applicants must include two letters of recommendation from Penn State Law faculty members and a career statement. Applicants to the joint degree program may submit LSAT scores instead of GRE scores.

Residency

Students will normally spend four semesters in residence at PSL and as many additional semesters in residence as needed to complete the additional requirements for the pertinent HIED degree. Ph.D. candidates must arrange the sequence of semesters to ensure that they are in residence as full-time students in the HIED program for at least two consecutive semesters (Fall-Spring or Spring-Fall) excluding summer in a single twelve-month period.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the J.D. program are listed on the Penn State Law website (<https://pennstatelaw.psu.edu/jd-degree-requirements/>). Degree requirements for the Ph.D., D.Ed., and M.Ed. degrees are listed on the Degree Requirements tab.

Penn State Law

A maximum of twelve credits for HIED course work may be double-counted for credit toward the J.D. degree at PSL. Students must obtain a grade satisfactory to PSL for the course work to be credited towards the J.D. degree. The following HIED courses may qualify for credit in PSL:

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
HIED 545	Foundations in Higher Education and Student Affairs	3
HIED 552	Administration and Organization in Higher Education	3
HIED 560	Legal Issues in Higher Education and Student Affairs	3
HIED 587	Education Policy and Politics	3
HIED 806	Teaching and Learning in Higher Education	3

Higher Education

The courses that may be double-counted will be determined by the student's degree program. Normally a maximum of twelve credits of PSL course work will be counted for credit for the minimum requirements for a master's degree, subject to approval by the student's advisory committee.

Sequence

The sequence of courses will be determined by the students and their advisors.

Recommended Program of Study and Advising

All students in the program will have two advisers, one from PSL and one from HIED. Periodic interaction between the two advisers is encouraged.

Tuition

Students will be charged the applicable PSL tuition to cover the J.D. program and the applicable graduate tuition to cover the HIED degree program. PSL tuition will be paid for the semesters in which the student is registered for PSL courses, and graduate tuition will be paid for the semesters in which the student is registered for graduate courses. A student may take up to one course (3 credit hours) per semester in the program where the student is not primarily registered without any change in tuition, but must pay additional tuition to the program that the student is not primarily registered if he or she wishes to take additional course work pursuant to that program during the semester.

Financial Aid and Assistantships

Decisions on financial aid and assistantships will be made by each school according to that school's procedures. Generally, assistantships and financial aid granted by HIED will not apply to time spent at PSL.

Fulfillment of Degree Requirements and Graduation

All courses in one program that will count toward meeting the requirements of the other program must be completed before the awarding of either degree. If students accepted into the joint degree program are unable to complete the J.D. degree, they are still eligible to receive the Higher Education degree if all Higher Education degree requirements have been satisfied.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)

- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Higher Education (HIED) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/hied/>)

Learning Outcomes

Master of Education (M.Ed.)

1. Demonstrate reading proficiencies to deal effectively with theoretical, empirical, and policy material in higher education.
2. Demonstrate writing proficiencies to analyze problems of practice, draw upon and apply concepts studied, and synthesize ideas into relevant and useful conclusions.
3. Demonstrate critical thinking skills that require suspended judgment and the application of relevant theory to varied areas of practice.
4. Demonstrate responsibility toward the goal of becoming a proactive, reflective, life-long learner.
5. Demonstrate the ability to collaborate with others to facilitate problem-solving and decision making through reflective practice.
6. Demonstrate an understanding of purpose, audience, and context in communication activities.
7. Demonstrate appropriate use of communication technologies.
8. Demonstrate an ability to draw upon key theories, concepts, and research findings to assess current issues and challenges facing higher education institutions.
9. Demonstrate the ability to collect and analyze data to improve practice in particular administrative areas of higher education.
10. Demonstrate an understanding of professional and ethical practice.

Doctor of Education (D.Ed.)

1. Distinguish various aspects of higher education—including perspectives on its past, present, and future.

2. Interpret and communicate knowledge of higher education that informs research, policy, and professional practice.
3. Demonstrate competence in designing and conducting applied research that results in, informs, and improves professional practice.
4. Identify and address ways in which power operates in higher education, and has been differentially distributed by race and by other marginalized social identities.
5. Utilize concepts, theories, and frameworks from education and other fields of inquiry in exploring and critically analyzing programs and practices in higher education.
6. Evaluate required competencies, needed preparation, and potential rewards relative to pursuing a range of career opportunities in all sectors of academia.

Doctor of Philosophy (Ph.D.)

1. Distinguish various aspects of higher education—including perspectives on its past, present, and future.
2. Interpret and communicate knowledge of higher education that informs research, policy, and professional practice.
3. Demonstrate competence in designing, conducting, and communicating (including in written form) research that generates new knowledge.
4. Identify and address ways in which power operates in higher education, and has been differentially distributed by race and by other marginalized social identities.
5. Utilize concepts, theories, and frameworks from education and other fields of inquiry in exploring and critically analyzing topics in higher education.
6. Evaluate required competencies, needed preparation, and potential rewards relative to pursuing a range of career opportunities in all sectors of academia.

Contact

Campus

University Park

Graduate Program Head

Kevin Kinser

Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)

Kelly Ochs Rosinger

Program Contact

Diane Lupp
400 Rackley Building
University Park PA 16802
dwl3@psu.edu
(814) 863-2690

Program Website

View (<https://ed.psu.edu/academics/departments/department-education-policy-studies/higher-education-program/>)

Campus	World Campus
Graduate Program Head	Kevin Kinser
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Kelly Ochs Rosinger
Program Contact	Diane Lupp 400 Rackley University Park PA 16802 dwl3@psu.edu (814) 863-2690
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/higher-education-masters/apply/)

History

Graduate Program Head	Amy Greenberg
Program Code	HIST
Campus(es)	University Park (Ph.D., M.A.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Arts (M.A.) Dual-Title Ph.D. in History and African American and Diaspora Studies Dual-Title Ph.D. in History and Asian Studies Dual-Title Ph.D. and M.A. in History and Women's, Gender, and Sexuality Studies Integrated B.A. in History and M.A. in History
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=HIST)

Graduate instruction at the master's and doctoral degree level is offered in the following areas:

- United States (19th and 20th century)
- Europe (Medieval, Early Modern, and Modern)
- Asia (Late Imperial and 20th century)
- Latin America (Colonial and Modern)
- Middle East

Only students focusing their course of study on the department's five primary areas of strength (Colonial Latin America, Early Modern Global, United States, China, and Middle East) are admitted into the graduate program. Courses in all other areas are offered on a regular basis and encouraged as secondary areas of focus.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Applicants to the doctoral program must hold or be near completion of the master's degree (or its equivalent); all others will be considered for

admission to the master's program, even if it is their ultimate intention to pursue a doctoral degree at Penn State.

To be considered for admission, applicants must submit a completed online Graduate School application (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>) and payment of the nonrefundable application fee. In addition, applicants must submit official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>) that show:

1. substantial course work in history,
2. a minimum GPA of 3.50 (on a 4.0 scale),
3. at least three semesters of college-level work in a foreign language (additional language training appropriate to the fields in which the applicant proposes to work may also be required for admission) and
4. where applicable, a minimum GPA of 3.50 for all graduate work previously undertaken.

The Department of History requires a statement of intent outlining proposed fields of study and career goals, as well as a sample of written work (undergraduate history thesis, master's thesis, seminar paper or equivalent research paper) as evidence of historical research and writing skills. Three letters of recommendation are required; it is strongly preferred that at least two of them be from historians. Graduate Record Examination (GRE) scores are not required.

Degree Requirements

Master of Arts (M.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The Director of Graduate Studies, who supervises the overall graduate program in history and maintains student records, will assign newly admitted graduate students to advisers on the basis of each student's expressed area of interest. Advisers provide assistance in planning courses of study, guidance in choosing scholarly papers and dissertation topics, direction in conducting research, and career counseling.

Students who serve as graduate assistants will be given a variety of experiences as they assist different professors, ranging from paper-grading and administering exams, to preparing and delivering occasional lectures, to conducting review or discussion sections for large lecture courses.

Candidates for the M.A. degree must earn a minimum of 36 credits of course work that can be counted towards a graduate degree, of which 12 credits will be in the student's primary area and 6 credits in one secondary area. At least 30 credits must be at the 500 level, with no more than 6 credits of HIST 596. The only required course is HIST 500. Course work offered by outside departments may be scheduled as part of the student's program with approval of the student's academic committee and the Director of Graduate Studies. In some cases, students may be required to take additional credits in order to make up deficiencies in foreign language skills and/or undergraduate coursework.

Reading proficiency in at least one foreign language must be demonstrated no later than the beginning of the second year of residence.

Students are required to convene two separate, formal meetings with their advisers and master's committees: Committee Formation Meeting and the Master's oral examination. The convening of the student's master's committee must take place no later than the end of the first year in the master's program. Every student should, in consultation with the permanent adviser, select at least two other members of the Graduate Faculty to serve on their master's committee (for a minimum total of three faculty members). There must be faculty representation of each of the students' two fields (selected from the department's list of officially recognized fields). At this first meeting there should be a discussion and approval of the general program plan (seminars, courses and other requirements).

Students must hold a Master's oral examination. The examination consists of an oral defense of two research papers written while in the M.A. program in two department-defined fields of study (e.g., 19th century US and Modern Europe). The research papers must be of a length, substance, and quality that the committee deems to be of journal article-caliber. Students must submit the papers to the committee a minimum of two weeks prior to the oral examinations; the papers then must be orally presented and successfully defended before the committee in the M.A. examination. Submission and defense of these two research papers constitutes the culminating experience for the Master of Arts degree.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The Director of Graduate Studies, who supervises the overall graduate program in history and maintains student records, will assign newly admitted graduate students to advisers on the basis of each student's expressed area of interest. Advisers provide assistance in planning courses of study, guidance in choosing scholarly papers and dissertation topics, direction in conducting research, and career counseling.

Students who serve as graduate assistants will be given a variety of experiences as they assist different professors, ranging from paper-grading and administering exams, to preparing and delivering occasional lectures, to conducting review or discussion sections for large lecture courses. Advanced doctoral students may hold lectureships while working on their dissertations; lecturers have complete instructional responsibility for one or two sections of an undergraduate course in their area of specialization.

Credits & Course Requirements

Candidates for the Ph.D. degree in History must complete at least 27 credits of graduate-level work at the 500-600 level (with no more than one HIST 596 per academic year), of which 12 credits will be in the student's primary area and 6 credits each in two secondary areas. The only required course is HIST 500. The remainder of a student's doctoral program, including foreign language requirements, should be determined in consultation with the Ph.D. committee. Course work offered by outside departments may be scheduled as part of the student's program with approval of the student's Ph.D. committee and the Director of Graduate Studies.

Foreign Language Requirements

Reading proficiency in at least one foreign language must be demonstrated no later than the third semester of residency (not including summer semester).

English Competence

A student in the Doctor of Philosophy in History degree program is required to demonstrate high-level competence in the use of the English language, including reading, writing, and speaking. At the end of the first year of enrollment all students who are non-native speakers of English must submit a portfolio which includes at least two pieces of written work from every seminar. In addition, the Director of Graduate Studies will solicit evaluations from their adviser(s) and seminar instructors in order to identify any deficiencies. Students with any identified deficiencies will be directed into appropriate remedial activities. The deficiencies must be met before the qualifying examination. Competence must be formally attested by the program before the doctoral comprehensive examination is scheduled. (International students should note that passage of the minimal TOEFL or IELTS requirement does not demonstrate the level of competence expected of a Ph.D. from Penn State.)

Ph.D. committee Composition

By the end of the first year in the doctoral program, every student should, in consultation with the permanent adviser, select at least two other members of the Graduate Faculty to serve on their Ph.D. committee. Ph.D. committees for History Ph.D. candidates must meet all Graduate Council requirements (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>).

Only those faculty who have been approved and designated by the Graduate School as members of the Graduate Faculty in History can serve as representatives of the three primary and secondary fields on any Ph.D. committee. The list of History Graduate Faculty is available online (<http://www.gradschool.psu.edu/gsfaculty/facultylist.cfm?program=90>).

Qualifying Examination

The qualifying examination may be taken after the completion of at least 18 credits of acceptable graduate work at Penn State and must be taken within three semesters (excluding summer sessions) of entry into the doctoral program. Following successful passage of the qualifying exam, a program plan will be submitted to the Departments of History and the participating program after consultation with members of the student's Ph.D. committee.

Formal Meetings

Students are required to convene two separate, formal meetings with their advisers and Ph.D. committees for:

1. a discussion and approval of the general program plan (seminars, courses and other requirements) and
2. their Ph.D. comprehensive examinations.

Doctoral Dissertation Defense

Upon the researching, writing, and completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense). The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Titles

Dual-Title Ph.D. in History and African American and Diaspora Studies

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Students must apply and be admitted to the graduate program in History and The Graduate School before they can apply for admission to the dual-title degree program. After admission to History, students must apply for admission to and meet the admissions requirements of the African American and Diaspora Studies dual-title program. Refer to the Admission Requirements section of the African American and Diaspora Studies Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/african-american-diaspora-studies/>). Doctoral students must be admitted into the dual-title degree program in African American and Diaspora Studies prior to taking the qualifying examination in their home department.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the Ph.D. in History. In addition, students pursuing the dual-title Ph.D. in History and African American and Diaspora Studies must complete the degree requirements for the dual-title Ph.D. in African American and Diaspora Studies, listed on the African American and Diaspora Studies Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/african-american-diaspora-studies/>).

Qualifying Examination

The qualifying examination committee must include at least one member of the African American and Diaspora Studies Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

The dual-title field must be fully integrated into the qualifying exam for the doctoral program. In addition, student in the dual-title Ph.D. in African American and Diaspora Studies will be required to present to their committee a portfolio of work in African American and Diaspora Studies which includes a statement of the student's interdisciplinary research interests, a program plan, and samples of writing that indicate the student's interest in questions taken up by scholars of African American and Diaspora Studies.

Ph.D. committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a History and African American and Diaspora Studies dual-title Ph.D. student must include at least one member of the African American and Diaspora Studies Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in African American and Diaspora Studies, the member of the committee representing African American and Diaspora Studies must be appointed as co-chair.

Comprehensive Exams

The African American and Diaspora Studies Graduate Faculty member on the student's committee is responsible for developing and administering the African American and Diaspora Studies portion of the student's comprehensive exams. The exam must incorporate written and oral components in African American and Diaspora Studies based on the student's thematic or regional area of interest and specialization in African American and Diaspora Studies. The African American and Diaspora Studies portion of the exam will include the following components: broad history of the field, contemporary theory and debates,

and either sexual and gender politics or a topic related to the student's specific area of interest.

Dissertation

Ph.D. candidates must complete a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in both History and African American and Diaspora Studies. In order to earn the dual-title Ph.D. degree, the dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School, and the student must pass a final oral examination (the dissertation defense).

Dual-Title Ph.D. in History and Asian Studies

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Graduate students with research and educational interests in Asian studies may apply to the dual-title Ph.D. in History and Asian Studies. The goal of the dual-title Ph.D. in History and Asian Studies is to enable graduate students from History to acquire the knowledge and skills of their major area of specialization in History while at the same time gaining the perspective of Asian Studies.

In order to prepare graduate students for the competitive job market, this program provides them with a solid disciplinary foundation that will allow them to compete for the best jobs in their field. For such students, the dual-title Ph.D. in History and Asian Studies will add value to their degree and their status as candidates. It will produce excellent historians who are experts in Asian Studies as well. The dual-title degree in History and Asian Studies will build curricular bridges beyond the student's major field so as to provide a unique training regime for the global scholar.

Admission Requirements

Students must apply and be admitted to the graduate program in History and The Graduate School before they can apply for admission to the dual-title degree program. After admission to History, students must apply for admission to and meet the admissions requirements of the Asian Studies dual-title program. Refer to the Admission Requirements section of the Asian Studies Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/asian-studies/>). Doctoral students must be admitted into the dual-title degree program in Asian Studies prior to taking the qualifying examination in their home department.

Degree Requirements

The doctoral degree in History and Asian Studies is awarded only to students who are admitted to the History Ph.D. program and subsequently admitted to the dual-title in Asian Studies. To qualify for the dual-title degree, students must satisfy the degree requirements for the Ph.D. in History. In addition, students pursuing the dual-title Ph.D. in History and Asian Studies must complete the degree requirements for the dual-title Ph.D. in Asian Studies, listed on the Asian Studies Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/asian-studies/>). The minimum course requirements for the dual-title Ph.D. degree in History and Asian Studies are as follows:

Code	Title	Credits
Required Courses		
HIST 580	Early Modern Asia	3
HIST 581	Modern China	3

ASIA 501 & ASIA 502	Proseminar in Asian Studies I and Proseminar in Asian Studies II (the required proseminar sequence in Asian studies)	6
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Select an additional 3 credits in an Asia-related course (400-level and above) in Asian Studies or in any department other than History 3

Total Credits 15

Foreign Language Requirements

All-skills proficiency in one Asian language and two years' college study (or equivalent knowledge) of another Asian language, or alternative proficiency appropriate to the student's field.

Qualifying Examination

There will be a single qualifying examination, containing elements of both History and Asian Studies. The qualifying examination committee must include at least one member of the Asian Studies Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

Students must meet the Ph.D. qualifying examination requirements specified by the History department. In addition, the student will be required to present a portfolio of work in Asian Studies to their committee. Such a portfolio would minimally include a statement of the student's interdisciplinary research interests and a program plan.

Ph.D. committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a History and Asian Studies dual-title Ph.D. student must include at least one member of the Asian Studies Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Asian Studies, the member of the committee representing Asian Studies must be appointed as co-chair.

Comprehensive Exams

The Asian Studies-affiliated faculty member on the student's committee is responsible for ensuring that Asian Studies content constitutes a portion of the student's comprehensive exams. The Asian Studies' content will focus on the following areas: theory, methodology, transnationalism, and interdisciplinary material related to the student's discipline.

Dissertation

Ph.D. candidates must complete a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in both History and Asian Studies. In order to earn the dual-title Ph.D. degree, the dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School, and the student must pass a final oral examination (the dissertation defense).

Dual-Title M.A. and Ph.D. in History and Women's, Gender, and Sexuality Studies

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://>

gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/).

Dual-title degrees in History and Women's, Gender, and Sexuality Studies foster interdisciplinary scholarly work that is grounded in historical study, research, and teaching. A dual-title program will enhance the intellectual rigor and breadth of graduate work through core courses in feminist theory and methodologies; by exposure to a range of interdisciplinary approaches to scholarship that focuses on the intersections of gender, sexuality, race, ethnicity, nation, and citizenship; and by offering students a pedagogical framework that encourages an interdisciplinary approach to teaching.

Admission Requirements

Students must apply and be admitted to the graduate program in History and The Graduate School before they can apply for admission to the dual-title degree program. After admission to History, students must apply for admission to and meet the admissions requirements of the Women's, Gender, and Sexuality Studies dual-title program. Refer to the Admission Requirements section of the Women's, Gender, and Sexuality Studies Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/womens-studies/>). Doctoral students must be admitted into the dual-title degree program in Women's, Gender, and Sexuality Studies prior to taking the qualifying examination in their home department.

Degree Requirements for the Dual-Title M.A.

To qualify for the dual-title degree, students must satisfy the degree requirements for the M.A. in History. In addition, students pursuing the dual-title M.A. in History and Women's, Gender, and Sexuality Studies must complete the degree requirements for the dual-title M.A. in Women's, Gender, and Sexuality Studies, listed on the Women's, Gender, and Sexuality Studies Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/womens-gender-sexuality-studies/>).

For the dual-title M.A., a minimum of one member of the master's committee will be a member of the Graduate Faculty in Women's, Gender, and Sexuality Studies.

Degree Requirements for the Dual-title Ph.D.

To qualify for the dual-title degree, students must satisfy the degree requirements for the Ph.D. in History. In addition, students pursuing the dual-title Ph.D. in History and Women's, Gender, and Sexuality Studies must complete the degree requirements for the dual-title Ph.D. in Women's, Gender, and Sexuality Studies, listed on the Women's, Gender, and Sexuality Studies Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/womens-gender-sexuality-studies/>).

Qualifying Examination

There will be a single qualifying examination, containing elements of both History and Women's, Gender, and Sexuality Studies. The qualifying examination committee must include at least one member of the Women's, Gender, and Sexuality Studies Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

Students must meet the Ph.D. qualifying examination requirements specified by the History department. In addition, the student will be required to present a portfolio of work in Women's, Gender, and Sexuality Studies to their committee. Such a portfolio would include:

- a statement of the student's interdisciplinary research interests,
- a program plan, and
- samples of writing that indicate the student's work in Women's, Gender, and Sexuality Studies.

Ph.D. committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a History and Women's, Gender, and Sexuality Studies dual-title Ph.D. student must include at least two members of the Women's, Gender, and Sexuality Studies Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee representing History is not also a member of the Graduate Faculty in Women's, Gender, and Sexuality Studies, one of the members of the Ph.D. committee representing Women's, Gender, and Sexuality Studies must be appointed as co-chair.

Comprehensive Exams

The Women's, Gender, and Sexuality Studies affiliated faculty members on the student's Ph.D. committee are responsible for ensuring that Women's, Gender, and Sexuality Studies content constitutes a portion of the student's comprehensive exams. The Women's, Gender, and Sexuality Studies content will focus on the following areas: feminist theory, feminist methodology, global feminism, and feminist studies

Dissertation

Ph.D. candidates must complete a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in both History and Women's, Gender, and Sexuality Studies. In order to earn the dual-title Ph.D. degree, the dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School, and the student must pass a final oral examination (the dissertation defense).

Integrated Undergrad-Grad Programs

Integrated B.A. in History and M.A. in History

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.A. in History with the M.A. in History offered at the following campuses:

Undergraduate Degree

- Abington
- University Park
- World Campus

Graduate Degree

- University Park

The graduate portion of this IUG is currently offered as face-to-face residential instruction. While the undergraduate curriculum for this IUG may be completed at multiple campuses, the ease and feasibility of completing the integrated program may be heavily dependent upon the location of the graduate instruction. Please discuss the feasibility of completing the IUG with a representative for the graduate program before beginning the application process.

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/>

[gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/](https://gradschool.psu.edu/graduate-education-policies/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/)).

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

In addition to the admission requirements noted on the Degree Requirements tab, admission to the History IUG will be based upon students' having:

1. completed at least one 400-level history course in a primary area of interest (with a B grade or higher) and attained a minimum GPA of 3.5 in all courses.
2. completed at least 60 credits (but no more than 100 credits).
3. submitted a proposed program plan directly to the Department of History's Director of Graduate Studies prior to the fall application deadline. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.

Students must apply to the program via the Graduate School application for admission (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet all the admission requirements of the Graduate School and the History graduate program for the Master of Arts degree. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.A. in History are listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.A. degree are listed on the Degree Requirements tab. Up to 14 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
HIST 453	American Environmental History	3
HIST 454	American Military History	3
HIST 514	Global History 1300-1800: Empires, Economy, and Civilizations	3
HIST 515	Early Modern Europe	3-6
HIST 516	US Women's and Gender History	3
HIST 544	Topics in the Civil War and Reconstruction	3
HIST 545	United States History, 1877 to Present	3

HIST 546	The Rise and Fall of Modern America, 1919 to the present	3
HIST 580	Early Modern Asia	3

History IUG students should compose their master's committee and convene a committee meeting with all members present in the semester immediately following admission to the IUG (typically the sixth semester). At this first meeting there should be a discussion and approval of the general program plan (seminars, courses, and other requirements).

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.A. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

In addition, the following awards typically have been available to graduate students in this program:

James Hamilton Hartzell and Lucretia Irvine Boyd Hartzell History Award

A \$200 to \$300 award made annually to a graduate student in the Department of History whose field of interest is Pennsylvania history.

James Landing Fellowship and the Warren Hassler Fellowship for Study in the Civil War

Each fellowship is available each year to doctoral candidates who are working on their dissertations. The award consists of a stipend that earns the successful candidate one semester of release time for research and writing. No tuition waiver is offered.

Hill Fellowships for Study in History

Awarded annually by the Department of History to doctoral candidates who are working on their dissertations. The amount of the award varies, but it generally supports one semester free of duties.

Edwin Erle Sparks Fellowship in the Humanities

One fellowship is available each year to doctoral candidates in the Department of History who are working on their dissertations.

Mark and Lucy Macmillan Stitzer Award

Awarded by the Department of History each year to support graduate student travel for the purpose of research. The number and value of these awards depends on the quality of proposals received, the level of funding required by each meritorious project, and the funds available in the endowment. Preference is given to request for doctoral dissertation research.

The E-Tu Zen Sun Award for Outstanding Teaching by a Graduate Assistant

One or two awards are made each year to recognize excellence in teaching by a History graduate assistant in the conduct of discussion sections, review sessions, or lecture presentations. The value of the award varies depending on funds available, but it is normally about \$200.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

History (HIST) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/hist/>)

Learning Outcomes.

Master of Arts (M.A.)

1. **KNOW:** Demonstrate familiarity with current and past historiographical theory and methods.
2. **THINK:** Evaluate primary and secondary source material relevant to a particular historical period and theoretical topic consistent with the ethical standards and practices of the discipline.
3. **APPLY/CREATE:** Formulate and execute independent research around a historical argument based on evidence.
4. **COMMUNICATE:** Follow the conventions of the discipline when articulating arguments and ideas in oral presentations and written formats.
5. **PROFESSIONAL PRACTICE:** Create a historical argument that meets professional standards of scholarly and professional work.

Doctor of Philosophy (Ph.D.)

1. **KNOW:** Demonstrate command of current and past historiographical theory and methods.
2. **THINK:** Evaluate and master primary and secondary source material relevant to a particular historical period and theoretical topic consistent with highest ethical standards and practices of the discipline.
3. **APPLY/CREATE:** Formulate and execute independent research around historical argument on the basis of evidence that further knowledge and theory in the field of historical studies.
4. **COMMUNICATE:** Articulate arguments and ideas with clarity in oral presentations and written formats in accordance with the conventions of the discipline.
5. **PROFESSIONAL PRACTICE:** Create historical arguments that demonstrate knowledge of professional standards of scholarly and professional work through their written and oral works and interaction with colleagues.

Contact

Campus	University Park
Graduate Program Head	Amy S Greenberg
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Kathryn Alexia Merkel-Hess Mcdonald
Program Contact	Kristi L Brinker 108 Weaver Building University Park PA 16802 klb776@psu.edu (814) 863-6433
Program Website	View (http://history.la.psu.edu/)

Homeland Security

Graduate Program Head	L. Marvin Overby
Program Code	HLS
Campus(es)	World Campus (M.P.S.)
Degrees Conferred	Master of Professional Studies (M.P.S.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=HLS)

The intercollege Master of Professional Studies in Homeland Security (iMPS-HLS) degree program is designed to prepare professionals and develop leaders for the field of homeland security by providing exceptional graduate education that includes an integrated curriculum, expert faculty, and student interaction. The program is comprised of courses from several Penn State colleges and delivered via distance education through the Penn State World Campus to accommodate the needs and careers of professionals who are already active in homeland security and related fields of civil security, or those interested in transitioning into the field. The program provides select graduate students with an integrated, cross-disciplinary curriculum that is focused on a set of unified educational goals to help them understand and manage the complexities of homeland security in a global environment. Within the degree program and in addition to its common core curriculum, students choose one of seven specialization areas that represent main elements, capabilities, and risk-informed priorities of the homeland security mission space:

1. base program
2. agricultural biosecurity and food defense option;
3. counterterrorism option;
4. cyber threat analytics and prevention option;
5. intelligence and geospatial analysis option;
6. public health preparedness option; or
7. information security and forensics option.

The participating academic units for this collaborative program are: Penn State Harrisburg, the College of Medicine (in collaboration with the Milton S. Hershey Medical Center), the College of the Liberal Arts, the College of Information Sciences and Technology, the College of Earth and Mineral Sciences, the College of Agricultural Sciences, and Penn State Great Valley.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Core Application Packet

- Completed online Graduate School application (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>) and payment of nonrefundable application fee
- Statement of purpose
- Vita or résumé
- Three letters of recommendation
- Official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>)

Statement of Purpose and Curriculum Vitae

A statement of professional experience and goals (up to 500 words) and the applicant's vita or résumé must accompany the application.

Letters of Recommendation

- The individuals writing letters should be familiar with you and comfortable discussing your professional and/or academic strengths and accomplishments.
- The Admissions Committee prefers that all letters be written within the last six months and reference the applicant's current career goals and/or ability to perform graduate level study.
- A person choosing to submit a letter of reference will do this through the online application system.
- A person choosing to submit a letter of reference may either select our pre-formatted template or upload their own letter.
- The program may waive letters of recommendation upon request from the applicant.

GPA Requirements

The applicant's grade-point average is interpreted by the Admissions Committee in the context of a completed application.

Other Considerations

Special backgrounds, abilities, and interests related to homeland security are desirable.

Degree Requirements

Master of Professional Studies (M.P.S)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The Master of Professional Studies in Homeland Security program requires a minimum of 33 credits, 24 of which must be earned at Penn State. Up to 10 graduate credits may be transferred in from a regionally accredited institution (subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>)); if the full 10 credits are transferred, the minimum total number of credits in the degree program will be 34. At least 18 credits must be courses at the 500 or 800 level, of which 6 credits must be in 500-level courses.

Students are expected to maintain a B (3.0) or better average in academic courses to be retained in the program. Graduate Council policy requires that students must have a GPA of 3.0 or above in order to graduate from the program.

Each student will take a 9-credit *core curriculum* consisting of HLS 801/PADM 801, HLS 803/PHIL 803, and HLS 805/PLSC 805, as well as a non-credit Orientation Course. Students will also take 12 credits of prescribed courses for the specialized option. There are 9 elective credits that are chosen from an approved list in consultation with the student's academic adviser. The list of electives is maintained by the Base Program and Option Directors and is provided to the students in the respective specialization area. Finally, each degree candidate must complete a capstone project on a topic related to homeland security and defense, in association with HLS 594/AGBIO 594/GEOG 594/INSC 594/IST 594/PHP 594/PLSC 594.

Time Limitation

All degree requirements for the Master of Professional Studies in Homeland Security must be met within five years of admission to degree status.

Prescribed Courses

Homeland security refers to the unifying core for the vast global network of organizations and institutions that are involved in the efforts to secure society. Regardless of field of specialization, or chosen discipline for graduate study, all professionals in the program will participate in a Unifying Core Curriculum with the following educational goals and objectives:

- Understand major policies and legislation that shapes homeland security in a globalized society.
- Become familiar with organizations that play a key role in the implementation of homeland security policies and administration, and recognize the interactions among them.
- Understand the way in which a person or group responds to a set of conditions so as to prevent and respond to incidents and catastrophic events when needed.
- Recognize the impact that catastrophic events, both natural and man-made, have on society and the domestic and global economy.
- Identify and assess potential threats, vulnerabilities, and consequences.
- Apply leadership skills and principles that are necessary for producing and acting on information of value within a collaborative setting.

- Communicate effectively in the context of particular institutional cultures.
- Use, conduct, and interpret research and data effectively in decision-making.
- Practice ethics and integrity as a foundation for analytical debate and conclusion.
- Develop an appreciation of the cultural, social, psychological, political, and legal aspects of terrorism and counterterrorism.

The Core Curriculum consists of the following four courses:

Code	Title	Credits
Required Courses		
HLS Orientation Course (non-credit)	Overview of program expectations, parts, academic specialization areas, and mechanics; as well as an essential overview of the field of homeland security and its community of practice. The Options may add content to aspects of homeland security that are specific to their academic specialization area.	0
HLS/PADM 801	Homeland Security Administration: Policies and Programs	3
HLS/PHIL 803	Homeland Security: Social and Ethical Issues	3
HLS/PLSC 805	Violence, Threats, Terror, and Insurgency	3
Total Credits		9

Listed below are the courses required/suggested for the Base Program and for the Options:

Homeland Security (Base Program)

Code	Title	Credits
Required Courses		
HLS Orientation		0
HLS/PADM 801	Homeland Security Administration: Policies and Programs	3
HLS/PHIL 803	Homeland Security: Social and Ethical Issues	3
HLS/PLSC 805	Violence, Threats, Terror, and Insurgency	3
<i>Base Program Prescribed Courses</i>		
HLS 811	Fundamentals of Homeland Security and Emergency Management	3
HLS 812	Homeland Security and Homeland Defense in Practice	3
HLS 813	Multifaceted Approaches to Homeland Security	3
HLS 558	Whole-Community Disaster Preparedness	3
Electives		
Choose 9 credits from an approved elective list in consultation with adviser. The list of electives is maintained by the Base Program Director and is provided to the students in the base program.		9
Capstone Experience		
HLS 594	Research Topics	3
Total Credits		33

Agricultural Biosecurity and Food Defense Option

Code	Title	Credits
Required Courses		
HLS Orientation		0
HLS/PADM 801	Homeland Security Administration: Policies and Programs	3

HLS/PHIL 803	Homeland Security: Social and Ethical Issues	3
HLS/PLSC 805	Violence, Threats, Terror, and Insurgency	3
<i>Agricultural Biosecurity and Food Defense Option Prescribed Courses</i>		
AGBIO 520	Agricultural Biosecurity: Protecting a Key Infrastructure	3
AGBIO 521	Food Defense: Prevention Planning for Food Processors	3
AGBIO 801	Veterinary Infectious Disease Diagnostic and Surveillance Systems	3
AGBIO 802	Plant Protection: Responding to Introductions of Threatening Pests and Pathogens	3

Electives

Choose 9 credits from an approved elective list in consultation with adviser. The list of electives is maintained by the Option Director and is provided to the students in the option. 9

Capstone Experience

AGBIO 594	Agricultural Biosecurity and Food Defense Capstone Experience	3
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Total Credits 33

Counterterrorism Option

Code	Title	Credits
Required Courses		
HLS Orientation		0
HLS/PADM 801	Homeland Security Administration: Policies and Programs	3
HLS/PHIL 803	Homeland Security: Social and Ethical Issues	3
HLS/PLSC 805	Violence, Threats, Terror, and Insurgency	3
<i>Counterterrorism Option Prescribed Courses</i>		
PLSC 836	Root Causes of Terrorism	3
PLSC 569	Counterterrorism	3
PLSC 838	Tools and Analysis of Counterterrorism	3
PLSC 837	Radicalization, Counter-Radicalization, and De-Radicalization	3

Electives

Choose 9 credits from an approved elective list in consultation with adviser. The list of electives is maintained by the Option Director and is provided to the students in the option. 9

Capstone Experience

PLSC 594	Research in Political Science	3
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Total Credits 33

Cyber Threat Analytics and Prevention Option

Code	Title	Credits
Required Courses		
HLS Orientation		0
HLS/PADM 801	Homeland Security Administration: Policies and Programs	3
HLS/PHIL 803	Homeland Security: Social and Ethical Issues	3
HLS/PLSC 805	Violence, Threats, Terror, and Insurgency	3
<i>Cyber Threat Analytics and Prevention Option Prescribed Courses (Choose 4 out of the following 5)</i>		
SWENG 545	Data Mining	3
INSC 561	Web Security and Privacy	3

INSC 846	Network and Predictive Analytics for Socio-Technical Systems	3
IST 564	Crisis, Disaster and Risk Management	3
INSC 831	Contemporary Information Systems Architecture	3

Electives

Choose 9 credits from an approved elective list in consultation with adviser. The list of electives is maintained by the Option Director and is provided to the students in the option. 9

Capstone Experience

INSC 594	Research Topics	3
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Total Credits 33

Intelligence and Geospatial Analysis Option

Code	Title	Credits
Required Courses		
HLS Orientation		0
HLS/PADM 801	Homeland Security Administration: Policies and Programs	3
HLS/PHIL 803	Homeland Security: Social and Ethical Issues	3
HLS/PLSC 805	Violence, Threats, Terror, and Insurgency	3
<i>Intelligence and Geospatial Analysis Option Prescribed Courses</i>		
GEOG 882	Geographic Foundations of Geospatial Intelligence	3
GEOG 483	Problem-Solving with GIS	3
GEOG 479	Spatial Data Science for Cyber and Human Social Networks	3
GEOG 885	Analytical Methods and GeoAI in Geospatial Intelligence	3

Electives

Choose 9 credits from an approved elective list in consultation with adviser. The list of electives is maintained by the Option Director and is provided to the students in the option. 9

Capstone Experience

GEOG 594A	Culminating Experiences in Geospatial Intelligence	1
GEOG 594B	Geospatial Intelligence Capstone Experience	2

Total Credits 33

Information Security and Forensics Option

Code	Title	Credits
Required Courses		
HLS Orientation		0
HLS/PADM 801	Homeland Security Administration: Policies and Programs	3
HLS/PHIL 803	Homeland Security: Social and Ethical Issues	3
HLS/PLSC 805	Violence, Threats, Terror, and Insurgency	3
<i>Information Security and Forensics Option Prescribed Courses</i>		
IST 454	Computer and Cyber Forensics	3
IST 456	Information Security Management	3
IST 815	Foundations of Information Security and Assurance	3
IST 554	Network Management and Security	3

Electives

Choose 9 credits from an approved elective list in consultation with adviser. The list of electives is maintained by the Option Director and is provided to the students in the option. 9

Capstone Experience

IST 594	Research Topics	3
Total Credits		33

Public Health Preparedness Option

Code	Title	Credits
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Required Courses

HLS Orientation		0
HLS/PADM 801	Homeland Security Administration: Policies and Programs	3
HLS/PHIL 803	Homeland Security: Social and Ethical Issues	3
HLS/PLSC 805	Violence, Threats, Terror, and Insurgency	3

Public Health Preparedness Option Prescribed Courses

PHP 410	Public Health Preparedness for Disaster and Terrorist Emergencies I	3
PHP 510	Public Health Preparedness for Disaster and Terrorist Emergencies II	3
PHP 527	Public Health Evaluation of Disasters and Bioterrorism	3
PHP 830	Critical Infrastructure Protection of Health Care Delivery Systems	3

Electives

Choose 9 credits from an approved elective list in consultation with adviser. The list of electives is maintained by the Option Director and is provided to the students in the option.	9
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Capstone Experience

PHP 594	Research Topics	3
Total Credits		33

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Homeland Security (HLS) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/hls/>)

Note that the options in the Homeland Security graduate program have separate course lists.

Learning Outcomes

Graduates from the iMPS-HLS program will be able to...

- SEARCH AND SYNTHESIZE** literature to integrate homeland security principles into disciplines and professional fields.
- INTEGRATE** the use of disciplinary methods, techniques, and knowledge to solve practical problems.
- IDENTIFY AND ASSESS** potential threats, vulnerabilities, and consequences in a context from local to global environments.
- EVALUATE** scientific evidence and best practice to inform and improve real-world decisions.
- PRACTICE** ethics and integrity as a foundation for analytical debate and conclusion.
- APPLY** leadership skills and principles to produce and act on information in a collaborative setting.
- COMMUNICATE** the major issues of their discipline effectively to a diverse community of the Homeland Security Enterprise.

Contact

Campus	World Campus
Graduate Program Head	L. Marvin Overby
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Emma Jane Leonard
Program Contact	Melissa D Forkey 777 West Harrisburg Pike 160W Olmsted Bldg. Middletown PA 17057 mpf5451@psu.edu (717) 948-6322
Program Website	View (https://www.worldcampus.psu.edu/degrees-and-certificates/homeland-security/overview/)

Option Directors

- Base Program:** Emma Leonard Boyle
- Agricultural Biosecurity and Food Defense Option:** Gretchen Kuldau
- Counterterrorism Option:** Andrew Vitek
- Cyber Threat Analytics and Prevention Option:** Robin Qiu
- Intelligence and Geospatial Analysis Option:** Gregory Thomas
- Information Security and Forensics Option:** David Fusco
- Public Health Preparedness Option:** Eugene J. Lengerich

Hospitality Management

Graduate Program Head	Donna Quadri-Felitti
Program Code	HM
Campus(es)	University Park (Ph.D., M.P.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Professional Studies (M.P.S.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=HM)

The graduate programs offered in Hospitality Management (HM) are widely considered to be among the most competitive in the world. The research-focused Ph.D. program is primarily designed for students pursuing careers in advanced research and academia. Students in this program are expected to work closely together with faculty members who are leading researchers in their respective fields. These mentorships provide first-hand training on how to successfully conceive, design, conduct, and report forward-looking research, while simultaneously providing a comprehensive understanding of the classroom environment through a structured teaching development program.

The M.P.S. in Hospitality Management program is a unique program of study designed for professionals aspiring to advance in the hospitality management and related careers. Careers in the global hospitality industry are rapidly changing and industry professionals are looking for ways to acquire new skills quickly and in a flexible format. The curriculum blends residential experiences in the School of Hospitality Management's first-class facilities with streaming technologies, blended and effective formats, web residential MBA courses offered by the Smeal College of Business. The MPS in HM will also have an industry internship component enabling students to gain first-hand managerial experience in the field, where necessary.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Applicants must submit the following materials:

- Penn State Graduate School application form and nonrefundable application fee
- A statement of career and educational goals including documentation of a minimum of two years of related full-time work. The statement should be an essay (2-3 pages in length) that demonstrates the applicant's written communication skills, along with a resume attached as a supplement.
- Three letters of recommendation that attest to the applicant's readiness for graduate study and that he or she has the requisite minimum of two years of work experience
- Official transcripts from all post-secondary institutions attended
- TOEFL/IELTS score, if applicable

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/>)

[gcac-300/gcac-305-admission-requirements-international-students/](https://gradschool.psu.edu/graduate-education-policies/gcac-300/gcac-305-admission-requirements-international-students/)) for more information.

Admissions decisions for the program are based on the quality of the applicant's credentials. The decisions are based on a review of the complete application portfolio.

Degree Requirements

MASTER OF PROFESSIONAL STUDIES (M.P.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The professional master's degree program is designed to provide students with a solid foundation on hospitality leadership practices, and thus, offer a unique opportunity for students looking to advance their careers in both the U.S. and internationally. A minimum of 33 credits at the 400, 500, or 800 level is required, with a minimum of 18 credits at the 500 or 800 level, and at least 6 credits at the 500 level. Each student must complete a core of 24 credits in HM and 12 credits through Smeal College of Business. A Hospitality Graduate Internship (3 credits) is required, but this requirement may be waived by the program head based on the student's previous industry experience and qualifications. A capstone course HM 880: Analysis of Future Trends in Hospitality Management (3 credits) serves as the culminating experience).

Code	Title	Credits
Required Courses		
HM 550	Hospitality Applied Research and Consulting	3
HM 560	Hospitality Data Analytics	3
HM 800	Dimensions and Directions of the Hospitality Industry (Executive In-Residence Weekend at UP)	3
MBADM 571	Global Strategic Management	3
MBADM 816	Managing and Leading People in Organizations	3
MBADM 811	Financial Accounting	3
MBADM 820	Financial Management	3
HM 820	Corporate Officer and Investor Perspectives	3
HM 830	Hospitality Profit Optimization	3
HM 840	Hospitality Customer Journey and Digital Reach	3
HM 895	Internship ¹	3
<i>Culminating Experience</i>		
HM 880	Analysis of Future Trends in Hospitality (Capstone Course)	3

¹ The internship requirement may be waived by the program head based on the student's previous industry experience and qualifications.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The doctoral program is an advanced graduate research program designed for students who want to become educators, researchers, and knowledge-based professionals in the hospitality field. Students' programs are individualized to ensure in addition to a mastery of the scope of knowledge in hospitality management they will also have the ability to complete significant research in a focused hospitality

management area. A student must complete the following courses prior to scheduling the Ph.D. comprehensive examination:

Code	Title	Credits
Required Courses		
HM 585	Seminar in Hospitality Management	3
HM 586	Data Analysis in Hospitality Management	3
HM 590	Colloquium (total of 4 credits)	4
12 credits of quantitative and statistical analysis		12
18 credits in an HM concentration area		18
12 credits from an outside supporting area		12
Total Credits		52

The language or communication requirement for the Ph.D. can be fulfilled by:

1. demonstrating proficiency in an approved foreign language, or
2. demonstrating proficiency in computer programming, or
3. completing a minor.

The demonstration of proficiency is determined by an HM faculty committee.

Ph.D. students must successfully pass a qualifying examination, a comprehensive examination, and a final oral examination (the dissertation defense). To earn the Ph.D. degree, doctoral candidates must write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

The School of Hospitality Management provides competitive funding for admitted Ph.D. students. Funding is typically guaranteed for the first three (3) years of a student's full-time participation in the program, and paid teaching opportunities generally offered in the fourth (4th) year, upon completion of structured teaching development program and approval of the faculty. In addition, other funding through the School partially supports graduate student travel and registration to leading conferences, as well as financial support with University-wide research competitions. Other funding opportunities also frequently exist for additional summer research, for varying lengths of time.

Students in the professional master's program may be eligible for financial aid; however, financial support is not guaranteed and is subject to the terms and conditions of the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) resources outlined on The Graduate School's website.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Hospitality Management (HM) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/hm/>)

Learning outcomes

MASTER OF PROFESSIONAL STUDIES (M.P.S.)

1. **KNOW:** Graduates will master advanced knowledge of the global hospitality industry and can distinguish the unique factors characterizing hospitality businesses as compared to businesses in other industries.
2. **APPLY/ CREATE:** Graduates will be able to apply data analytics and related research skills to solve problems facing the various segments of the hospitality industry. They will be able to use these skills to enhance brand value in competitive business environments.
3. **COMMUNICATE:** Graduates will display outstanding communication skills. They will be able to write business documents of professional quality and deliver persuasive oral presentations, commensurate with positions of advanced responsibility.
4. **THINK:** Graduates will demonstrate the ability to think critically about current and future challenges in hospitality management. They will be able to adapt to and lead others in managing change. Graduates will be able to integrate advanced ideas, skills, knowledge, and experience to positively impact their organizations.
5. **PROFESSIONAL PRACTICE:** Graduates will be able to conduct themselves in accordance with the highest ethical standards and be able to demonstrate the relevance of advanced hospitality education to any managerial environment. They will be able to motivate others by example and guidance.

DOCTOR OF PHILOSOPHY (PH.D.)

1. **KNOW:** Students will be able to demonstrate mastery of their specific research area.
 - a. They will demonstrate appropriate breadth and depth of disciplinary knowledge, and comprehension of the major issues of hospitality management and related areas of study.

2. **APPLY/CREATE:** Students will be able to design and execute a research project in their field of study both independently and with others; they will also be able to teach a course following sound pedagogical principles.
3. **THINK:** Students will be able to think critically about research in hospitality management and their areas of specialization.
 - a. They will demonstrate analytical and critical thinking in hospitality and related fields.
4. **COMMUNICATE:** Students will be able to use standards of field in written and oral communication
 - a. They will effectively communicate scholarly outcomes both orally and in writing.
5. **PROFESSIONAL PRACTICE:** Students will be able to identify ethical issues in research, teaching and the profession.
 - a. They will know and conduct themselves in accordance with the highest professional standards and demonstrate the value of inclusion and diversity.

Contact

Campus	University Park
Graduate Program Head	Donna L Quadri-Felitti
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Anna S Mattila
Program Contact	Amina Atkins ava6807@psu.edu (814) 863-1448

Human Development and Family Studies

Graduate Program Head	Douglas Teti
Program Code	HDFS
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Dual-Title Ph.D. in Human Development and Family Studies and Clinical and Translational Sciences Dual-Title Ph.D. and M.S. in Human Development and Family Studies and Demography Dual-Title Ph.D. in Human Development and Family Studies and Social and Behavioral Neuroscience Dual-Title Ph.D. in Human Development and Family Studies and Social Data Analytics
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=HDFS)

This interdisciplinary program is one of the graduate programs of the College of Health and Human Development. It is administered through the Department of Human Development and Family Studies. The Human Development and Family Studies graduate program is designed to educate students about research, theory, and methodology related to the study of individuals and families across diverse populations

and diverse settings. There is a strong interest in the ways in which social institutions and settings such as day care facilities, schools, neighborhoods, and social policy institutions facilitate (or inhibit) opportunities for development and change for individuals and families. Understanding the characteristics and conditions that place individuals or families at risk for developing problems, designing effective prevention programs to address those risks, and mounting rigorous evaluations of such programs is a growing emphasis in the program. All students, regardless of substantive area, are encouraged to develop strong skills in research methods, a hallmark of our graduate training. Through course work and apprenticeship experiences, students develop an understanding of the program's multidisciplinary life span/life course, and applied orientation. As students progress through the program, they are expected to develop specialized expertise in two or more of the department's areas of concentration: individual development, family studies, intervention research, and research methods.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Entering students should have some course work in social sciences, such as developmental and family science courses from psychology or sociology programs; and foundational courses in research methods and statistics. At the discretion of the program, students not meeting these requirements may be provisionally admitted (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/provisional-admission/>) with limited deficiencies to be made up concurrently with their graduate work. GRE scores will not be accepted

Students with appropriate backgrounds will be considered for admission for fall semester only. The best-qualified applicants will be accepted up to the number of spaces that are available for new students. The program does not admit applicants for the terminal master's degree.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Students who enter the graduate program without a master's degree must complete a master's degree en route to the Ph.D. For the Master of Science degree, a minimum of 31 credits at the 400, 500, 600, or 800 level is required, with at least 18 credits in the 500 and 600 series combined. Students are required to complete the following:

Code	Title	Credits
Required Courses		
HDFS 501	Human Development Across the Lifespan	3
HDFS 503	Human Development Intervention: Analysis of Theories and Approaches	3
HDFS 525	Introduction to Family Studies	3
<i>Research Methods</i>		
HDFS 516	Methods of Research in Human Development	3
HDFS 519	Methods of Statistical Analysis in Human Development	3

<i>Methods Lab</i>		
HDFS 518	Applied Statistics Laboratory	1
<i>Substantive Field</i>		
A minimum of 9 credits of course work (400 and 500 level) in their substantive field, 6 of which must be in HDFS (excluding HDFS 596 independent study)		9
Culminating Experience		
HDFS 600	Thesis Research	6
	or HDFS 610 Thesis Research Off Campus	
Total Credits		31

The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School, and the student must pass a thesis defense. Course work completed for the HDFS master's degree at Penn State can be applied to satisfy the degree requirements for the HDFS Ph.D.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

For the Ph.D., a minimum of 42.5 credits at the 400, 500, 600, or 800 level is required. Students are required to complete the following:

Code	Title	Credits
Required Courses		
HDFS 501	Human Development Across the Lifespan	3
HDFS 503	Human Development Intervention: Analysis of Theories and Approaches	3
HDFS 525	Introduction to Family Studies	3
HDFS 590	Colloquium (Professional Development Orientation) ¹	1
HDFS 515	Professional Issues in Human Development and Family Studies ²	1.5
<i>Research Methods</i>		
HDFS 516	Methods of Research in Human Development	3
HDFS 519	Methods of Statistical Analysis in Human Development	3
HDFS 523	Strategies for Data Analysis in Developmental Research	3
HDFS 526	Measurement in Human Development	3
<i>Methods Lab</i>		
HDFS 518	Applied Statistics Laboratory	1
Electives		18
A minimum of 6 additional credits in methodology		
A minimum of 6 credits in non-methodology courses.		
Total Credits		42.5

¹ Must be taken in the first year.

² Must be taken by the end of the second year in the program.

All doctoral students must pass a qualifying examination, a comprehensive written and oral examination, and a final oral examination (the dissertation defense). To earn the Ph.D. degree, doctoral students

must also write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Titles

Dual-Title Ph.D. in Human Development and Family Studies and Clinical and Translational Sciences

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

HDFS doctoral students interested in having a degree that reflects advanced training in the design, analysis, interpretation, implementation, and dissemination of clinical prevention/intervention programs aimed at improving human health across a range of contexts and developmental stages may apply to pursue a dual-title Ph.D. in HDFS and Clinical and Translational Sciences. The dual-title program is applicable for students pursuing academic careers in the area of basic research focused on processes that can be targeted through intervention practice, the development or improvement of intervention programs, or the science of translation and dissemination; or for students pursuing non-academic careers related to public health, policy, service delivery, cost effectiveness or cost-benefit program evaluation. The CTS dual-title complements the expertise students in HDFS acquire in individual development across the lifespan, contextual processes that influence individual development (communities, schools, families, workplace) and may be a target for intervention, a context for providing an intervention, or a potential impediment to effective service delivery of an intervention.

Admission Requirements

Students must apply and be admitted to the graduate program in HDFS and the Graduate School before they can be admitted to a dual-title degree program. Applicants interested in the dual-title degree program may note their interest in their applications to HDFS. Students admitted to the HDFS program will be admitted to the dual-title program in Clinical and Translational Sciences upon the recommendation of a faculty member affiliated with the dual-title. Refer to the Admission Requirements section of the CTS Bulletin page (p. 204). Students must apply and be admitted to the dual-title degree program prior to taking the qualifying exam.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the requirements of the Ph.D. in HDFS. In addition, students pursuing the dual-title Ph.D. in HDFS and Clinical and Translational Sciences must complete the degree requirements for the dual-title Clinical and Translational Sciences Ph.D., listed on the Clinical and Translational Sciences Bulletin page (p. 204).

Students' Qualifying Examination committee for the dual-title degree must fulfill composition requirements for HDFS, and at least one of the committee members must hold Graduate Faculty status in Clinical and Translational Sciences. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both HDFS and Clinical and Translational Sciences. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/>

gcac/gcac-600/phd-dissertation-committee-formation/), the Ph.D. committee of a dual-title doctoral degree student must either be chaired by a faculty member holding appointments in both HDFS and Clinical and Translational Sciences, or be co-chaired by two faculty members who each represent one discipline. The Ph.D. committee will oversee the Comprehensive Exam, which must meet the requirements established in the HDFS department, as well as requires the demonstration of expertise in an area deemed relevant to Clinical and Translational Sciences by the Committee chair or co-chair.

Ph.D. candidates must complete a dissertation on a topic that reflects their original research on a topic approved by the CTS program; specifically, one that “translates biomedical discovery into applications with the goal of improving human health”. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title M.S. and Ph.D. in Human Development and Family Studies and Demography

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

This program is designed for students who want to integrate Population Studies (including such foci as fertility, marriage, cohabitation, labor force participation, mortality) with the study of human development and family studies.

Admission Requirements

Students must apply and be admitted to the graduate program in HDFS and the Graduate School before they can be admitted to a dual-title degree program. Applicants interested in the dual-title degree program may note their interest in their applications to HDFS. Students admitted to the HDFS program will be admitted to the dual-title program in Demography upon the recommendation of a Demography Program faculty member in HDFS. Ph.D. students must apply and be admitted to the dual-title degree program in Demography prior to taking the qualifying exam.

Additional admissions requirements are listed in the Admissions Requirements section of the Demography Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/demography/>).

Degree Requirements

To qualify for the dual-title degree, students must satisfy the requirements of the Ph.D. in HDFS. In addition, students pursuing the dual-title Ph.D. in HDFS and Demography must complete the degree requirements for the dual-title Demography Ph.D., listed on the Demography Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/demography/>).

The qualifying examination committee for the dual-title degree will be composed of Graduate Faculty from HDFS and must include at least one Graduate Faculty member from Demography. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both HDFS and Demography. Dual-title graduate degree students may require an additional semester to fulfill requirements for

both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the chair and at least one additional member of the student's Ph.D. committee must be members of the Graduate Faculty in Demography. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. The Demography faculty members on the student's committee are responsible for administering an examination in demography that constitutes a portion of the comprehensive examination of the doctoral student in the dual-title.

Ph.D. candidates must complete a dissertation on a topic that reflects their original research and education in both HDFS and Demography. In order to earn the dual-title Ph.D. degree, the dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School, and the student must pass a final oral examination (the dissertation defense).

Dual-Title Ph.D. in Human Development and Family Studies and Social and Behavioral Neuroscience

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

HDFS doctoral students interested in having a degree that reflects interdisciplinary training in social and behavioral neuroscience as relevant to the domains of research expertise within HDFS (e.g. integrating neuroscience techniques and perspectives to understanding individual development across the lifespan, effects of contextual environments e.g. families, schools, work, on physical and mental development, development and assessment of prevention programs, and application of advanced statistical methods for the analysis of neuroscience data), may apply to pursue a dual-title Ph.D. in HDFS and Social and Behavioral Neuroscience.

Social and Behavioral neuroscience reflects the study of how brain development and function influence, and are influenced by, social environments and human interaction. The dual-title Ph.D. program provides students with additional training in the neurobiological foundations of brain function in order to enable them to pursue innovative interdisciplinary research with intellectual sophistication.

Admission Requirements

Students must apply and be admitted to the graduate program in HDFS and the Graduate School before they can be admitted to a dual-title degree program. Applicants interested in the dual-title degree program may note their interest in their applications to HDFS. Students admitted to the HDFS program will be admitted to the dual-title program in Social and Behavioral Neuroscience upon the recommendation of a Social and Behavioral Neuroscience Program faculty member in HDFS. Students must apply and be admitted to the dual-title degree program in Social and Behavioral Neuroscience prior to taking the qualifying exam.

Additional admissions requirements are listed in the Admissions Requirements section of the Social and Behavioral Neuroscience Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/social-behavioral-neuroscience/>).

Degree Requirements

To qualify for the dual-title degree, students must satisfy the requirements of the Ph.D. in HDFS, listed above. In addition, students pursuing the dual-title Ph.D. in HDFS and Social and Behavioral Neuroscience must complete the degree requirements for the dual-title Social and Behavioral Neuroscience Ph.D., listed on the Social and Behavioral Neuroscience Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/social-behavioral-neuroscience/>).

The Qualifying Examination committee for the dual-title degree will be composed of Graduate Faculty from HDFS and must include at least one Graduate Faculty member from Social and Behavioral Neuroscience. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both HDFS and Social and Behavioral Neuroscience. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a dual-title doctoral degree student must include at least two members of the Social and Behavioral Neuroscience Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the committee representing HDFS is not also a member of the Graduate Faculty in Social and Behavioral Neuroscience, the member of the committee representing Social and Behavioral Neuroscience must be appointed as co-chair. It is expected that the outside member of the Ph.D. committee serve as the second Social and Behavioral Neuroscience representative. Exceptions (e.g. having both Social and Behavioral Neuroscience committee members from within the home department) must be approved by the Social and Behavioral Neuroscience Steering committee. The Social and Behavioral Neuroscience representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Ph.D. candidates must complete a dissertation on a topic that reflects their original research and their education in both HDFS and Social and Behavioral Neuroscience. In order to earn the dual-title Ph.D. degree, the dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School, and the student must pass a final oral examination (the dissertation defense).

Dual-Title Ph.D. in Human Development and Family Studies and Social Data Analytics

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

HDFS doctoral students interested in having a degree that reflects interdisciplinary training in an array of tools, techniques, and methodologies for social data analytics, while maintaining a close association with HDFS, may apply to pursue a dual-title Ph.D. in HDFS and Social Data Analytics.

Social data analytics is the integration of social scientific, computational, informational, statistical, and visual analytic approaches to the analysis of large or complex data that arise from human interaction. The dual-title Ph.D. program provides additional training with the aim of providing

scientists with the skills required to expand the field of social data analytics, creatively answer important social scientific questions, and communicate effectively with both academic and nonacademic audiences.

Admission Requirements

Students must apply and be admitted to the graduate program in HDFS and the Graduate School before they can be admitted to a dual-title degree program. Applicants interested in the dual-title degree program may note their interest in their applications to HDFS. Students admitted to the HDFS program will be admitted to the dual-title program in Social Data Analytics upon the recommendation of a Social Data Analytics Program faculty member in HDFS. Students must apply and be admitted to the dual-title degree program in Social Data Analytics prior to taking the qualifying exam.

To be enrolled in the dual-title doctoral degree program in Social Data Analytics, a student must submit a letter of application and transcript, which will be reviewed by the Social Data Analytics Admissions Committee. An applicant must have a minimum grade point average of 3.0 (on a 4-point scale) to be considered for enrollment in the dual-title degree program. Students must be admitted into the dual-title degree program in Social Data Analytics no later than the end of the fourth semester (not counting summer semesters) of entry into the primary Ph.D. program and before taking the comprehensive exam.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the requirements of the Ph.D. in HDFS. In addition, students pursuing the dual-title Ph.D. in HDFS and Social Data Analytics must complete the degree requirements for the dual-title Social Data Analytics Ph.D., listed on the Social Data Analytics Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/social-data-analytics/>).

The qualifying examination in HDFS satisfies the qualifying exam requirement for the dual-title degree program in Social Data Analytics.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a dual-title doctoral degree student must include at least one member of the Social Data Analytics Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the committee representing HDFS is not also a member of the Graduate Faculty in Social Data Analytics, the member of the committee representing Social Data Analytics must be appointed as co-chair. The Social Data Analytics representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Ph.D. candidates must complete a dissertation on a topic that reflects their original research and education in both HDFS and Social Data Analytics. In order to earn the dual-title Ph.D. degree, the dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School, and the student must pass a final oral examination (the dissertation defense).

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/>

graduate-education-policies/), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Human Development and Family Studies (HDFS) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/hdfs/>)

Learning Outcomes

Master of Science (M.S.)

1. **KNOW:** Graduates will demonstrate an understanding of core theories and methods related to lifespan development, family process, and prevention science.
2. **THINK, KNOW, APPLY/CREATE:** Graduates will demonstrate skills in statistics and research methods with an emphasis on selecting and applying methods in conjunction with theory specific to their area of study.
3. **PROFESSIONAL PRACTICE, KNOW:** Graduates will comply with standard ethical regulations regarding the conduct of research, knowledge of ethical guidelines regarding the analysis and publication of scientific research.
4. **COMMUNICATE:** Graduates will communicate, in both written and oral formats, the importance and relevance of a research topic as well as the implications research results have for the field.
5. **APPLY/CREATE, THINK:** Graduates will be able to review the relevant literature and generate ideas for novel research.
6. **PROFESSIONAL PRACTICE, KNOW, COMMUNICATE, THINK:** Graduates will demonstrate an understanding of current and past systemic racism, bigotry, bias, and other forms of discrimination and their negative impacts on human development and families

across the lifespan, with an emphasis on ways to actively intervene to promote healthy development, diversity, equity, and inclusion.

Doctor of Philosophy (Ph.D.)

1. **KNOW:** Graduates will demonstrate an understanding of core theories and methods related to lifespan development, family process, and prevention science
2. **KNOW, APPLY/CREATE:** Graduates will demonstrate skills in statistics and research methods with an emphasis on selecting and applying methods in conjunction with theory specific to their area of study.
3. **KNOW, THINK, COMMUNICATE:** Graduates will demonstrate a mastery of the literature in their research area and an ability to integrate and communicate knowledge across at least 2 core department areas.
4. **COMMUNICATE:** Graduates will communicate, in both written and oral formats, the importance and relevance of a research topic as well as the implications research results have for the field.
5. **APPLY/CREATE, THINK, COMMUNICATE:** Graduates will demonstrate the ability to develop independent research questions to be addressed empirically, conduct the empirical analyses, and convey findings in a manner suitable for dissemination to the field.
6. **PROFESSIONAL PRACTICE, KNOW:** Graduates will comply with standard ethical regulations regarding the conduct of research, knowledge of ethical guidelines regarding the analysis and publication of scientific research.
7. **PROFESSIONAL PRACTICE, KNOW, COMMUNICATE, THINK:** Graduates will demonstrate an understanding of current and past systemic racism, bigotry, bias, and other forms of discrimination and their negative impacts on human development and families across the lifespan, with an emphasis on ways to actively intervene to promote healthy development, diversity, equity, and inclusion.

Contact

Campus	University Park
Graduate Program Head	Douglas Michael Teti
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Heidemarie Laurent
Program Contact	Christa Kreps 115 HHD Bldg University Park PA 16802 csh5007@psu.edu (814) 863-8001
Program Website	View (https://hhd.psu.edu/hdfs/human-development-and-family-studies-graduate-program/)

Human Resources and Employment Relations

Graduate Program Head	Paul F. Clark
Program Code	HRER
Campus(es)	University Park (M.S., M.H.R.E.R.) World Campus (M.H.R.E.R.)
Degrees Conferred	Master of Science (M.S.) Master of Human Resources and Employment Relations (M.H.R.E.R.) Integrated B.S. in Labor and Human Resources and M.S. in Human Resources and Employment Relations Integrated B.S. in Labor and Human Resources and M.H.R.E.R. in Human Resources and Employment Relations Integrated B.S. in Psychology and M.S. in Human Resources and Employment Relations Integrated B.S. in Spanish and M.S. in Human Resources and Employment Relations Integrated B.S. in Communication Arts and Sciences and M.S. in Human Resources and Employment Relations Integrated B.A. in Communication Arts and Sciences and M.S. in Human Resources and Employment Relations Joint J.D./M.S. with Penn State Law View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=HRER)
The Graduate Faculty	

Master of Science in Human Resources and Employment Relations

The Master of Science (M.S.) degree in Human Resources and Employment Relations (HRER) is a two-year program designed for students anticipating careers in some aspect of human resource management or employment relations.

After completing the program:

- Students will have and be able to demonstrate the necessary advanced knowledge and competence in the fields to excel in Human Resource Management and Employment Relations careers.
- Students will be able to effectively communicate knowledge of current topics in the fields both verbally and in writing to excel as Human Resource Management and Employment Relations professionals.
- Students will be able to recognize and analyze practical, legal, and ethical challenges in domestic and global workplaces.
- Students will be able to respond appropriately to practical, legal, and ethical challenges in domestic and global workplaces using both theoretical and practical approaches and in accordance with the standards, values and best practices of their discipline.

- Students will be able to interact effectively with other organizational leaders in helping to develop and implement organizational strategies.

Master of Human Resources and Employment Relations

The Master of Human Resources and Employment Relations (MHRER) is a 30 - 33-credit program of study for professionals working in human resources/employment relations or considering a career in some aspect of human resources and employment relations. The program will prepare students to:

- understand the roles that employers, employees, employee organizations and unions, and public policy makers play in the employment relationship;
- analyze the complex personal, legal, and organizational issues inherent in the employment relationship;
- understand the ethical dimensions of human resource and employment relations; and
- analyze complex issues and evaluate research results in the process of administering labor and human resource systems;

Courses include the study of employment law, labor and employment relations, human resources, workplace organization, labor markets, ethics, the employment relationship, recruiting/selection, compensation and benefits, workforce development, and diversity in the workplace.

The program highlights the changing nature of the HRER field, including the impact of the globalization of private and public organizations and the growing importance of diversity in the workforce. It culminates in a capstone project in which students will demonstrate their understanding of the curriculum and apply it to their professional areas of interest. Upon completion of the MHRER, students will be equipped to work as professionals in human resource management, employment relations, and general management with private employers, unions, government agencies, and non-profit organizations.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Master of Human Resources and Employment Relations (m.H.R.E.R.)

Applicants with a 3.00 junior/senior grade-point average (on a 4.00 scale) will be considered for admission. Exceptions to the minimum grade-point average may be made at the discretion of the program for students with special backgrounds, abilities, and interests.

Admissions decisions for the program are based on the quality of the applicant's credentials. The decisions are based on a review of the complete application portfolio. During the admission process, students who are better suited for another graduate program will be encouraged to apply to the appropriate program. Applicants to the MHRER must submit the following materials:

- Short Answer Questions: Applicants will be asked to respond to the following 4 questions within the graduate application. The answers to these questions will allow the admissions committees to get to know more about the candidate, their goals, and experiences.

- What are your short-term and long-term education/career goals and how do you expect this program to impact those goals?
- Describe what attracted you to this program and how you think it will support your education and professional aspirations.
- Explain how you are prepared/preparing to succeed in a rigorous graduate program. Discuss your strategies and perceived challenges that you may have related to time management or other relevant factors.
- Give an example of a time in which you received constructive criticism related to your work or study. What was it, who did it come from, and how did you apply it going forward?
- Official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>).
- One letter of recommendation that attests to the applicant's readiness for graduate study.

Graduate Record Examination (GRE) scores are not required.

Master of Science (M.S.)

Applicants to the M.S. HRER program:

- Must submit a 2-3 page essay articulating career and educational goals that demonstrates the applicant's written communication skills.
- Must submit a resume.
- Must submit a writing sample - Preferably an individually written essay or research paper that the student submitted in a college course (Please note: the resume is not considered to be a writing sample).
- Must submit scores from the Graduate Record Examinations (GRE) or the Graduate Management Admission Test (GMAT)
- Must submit official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>). Applicants with a 3.00 junior/senior grade-point average (on a 4.00 scale) will be considered for admission. Exceptions to the minimum grade-point average may be made at the discretion of the program for students with special backgrounds, abilities, and interests.
- Must submit three letters of recommendation sent from people who can adequately assess the student's likelihood of completing the graduate program.

Degree Requirements

Master of Human Resources and Employment Relations (m.H.R.E.R.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The MHRER program is designed to provide students with a solid foundation in human resources and employment relations and offers a unique opportunity for students to advance their careers in the field. A minimum of 33 credits at the 400, 500, or 800 level is required with a minimum of 18 credits at the 500 or 800 level, and at least 6 credits at the 500 level. Each student must complete a core of 21 credits in HRER, with 9 credits of electives. Students with at least three years of full-time relevant human resources or employment relations professional work experience can waive 3 credits of electives, with the graduate program

director's approval. A capstone course, HRER 894 or HRER 588, serves as the culminating experience.

Code	Title	Credits
Required Courses		
HRER 501 or HRER 810	Labor and Employment Law	3
HRER 504	Seminar in Employment Relations	3
HRER 505	Seminar in Human Resources	3
HRER 512	Research Methods and Analytics in Human Resources and Employment Relations	3
HRER 802 or HRER 502	Human Behavior and Organizational Performance Human Behavior at Work	3
HRER 825	Strategic Business Tools for HRER Professionals	3
<i>Choose one course (3 credits) from the following list:</i>		
LHR 499	Foreign Studies	
HRER 500	Topics in Comparative Industrial Relations	
HRER 503	Seminar in International Human Resources Studies	
HRER 803	Human Resources in Multinational Enterprises	
HRER 865	Diversity and Ethics in the Workplace	
Electives		
Choose three electives (9 credits) from a list of HRER, LHR, OLEAD, and LGWR courses maintained by the program office.		9
Culminating Experience		
HRER 894 or HRER 588	Research Topics (Capstone Project) Capstone in Human Resources and Employment Relations	3
Total Credits		33

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A minimum of 39 credits at the 400, 500, 600, or 800 level is required; with at least 18 credits in the 500 and 600 series. A minimum of 12 credits in course work (400, 500, and 800 series) must be completed in HRER. If the student chooses to write a thesis, at least 6 credits in thesis research (HRER 600) must be completed. The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School, and the student must pass a thesis defense. If the student chooses the capstone course track, at least 18 credits must be in 500-level courses.

For the degree, an overall 3.00 (B) grade-point average must be earned in the 400, 500, and 800-level courses, and a grade of B or above must be earned in all 500-level courses. Required courses are offered once per academic year and elective courses at least once every two academic years.

Code	Title	Credits
Core Curriculum		
HRER 501	Labor and Employment Law	3
HRER 502	Human Behavior at Work	3
HRER 504	Seminar in Employment Relations	3
HRER 505	Seminar in Human Resources	3

HRER 512	Research Methods and Analytics in Human Resources and Employment Relations	3
HRER 825	Strategic Business Tools for HRER Professionals	3
<i>Human Resources and Employment Relations (Base Program)</i>		
LHR 480	Current Issues in Human Resources	3
LHR 437	Workplace Dispute Resolution	3
HRER 536	Diversity in the Workplace	3
HRER 523	Seminar in Work-Life Dilemmas, Practices, and Policies	3

Electives

Students who choose the capstone course track must select 6 credits from an approved elective list in consultation with their adviser in addition to the capstone course, HRER 588. Students choosing the thesis track must select 3 credits from an approved elective list in consultation with their adviser in addition to the 6 credits of thesis research (HRER 600). The list of elective courses is maintained by the graduate program office.

Culminating Experience

Students can choose between the capstone course track or thesis track:

HRER 588	Capstone in Human Resources and Employment Relations (Capstone Course)	3
HRER 600	Thesis Research	6

Total Credits **39**

Human Resource Management option

Code	Title	Credits
Option-Specific Courses		
HRER 527	Talent Development and Change Management	3
HRER 503	Seminar in International Human Resources Studies	3
HRER 526	Managing Talent Flow	3
HRER 824	Total Rewards	3
Total Credits		12

Employment Relations Option

Code	Title	Credits
Option-Specific Courses		
<i>Required</i>		
HRER 500	Topics in Comparative Industrial Relations	3
LHR 401	The Law of Labor-Management Relations	3
Select 6 credits from the following:		6
LHR 468	American Labor Unions	
LHR 435	Labor Relations in the Public Sector	
LHR 475H	Labor in the Global Economy	
LGWR 510	International Labor Law	
LGWR 520	Global Workers' Rights	
Total Credits		12

Integrated Undergrad-Grad Programs

Integrated B.S. in Labor and Human Resources and Master Of Human Resources and Employment Relations

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Labor and Human Resources with the M.H.R.E.R in Human Resources and Employment Relations offered at the following campuses:

Undergraduate Degree

- University Park
- World Campus

Graduate Degree

- University Park
- World Campus

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The integrated Labor and Human Resources B.S. and Master of Human Resources and Employment Relations (MHRER) is a five-year program designed for academically talented World Campus baccalaureate students to obtain both the B.S. in Labor and Human Resources and MHRER in an intense, accelerated program of study. Students will develop expertise in the human resources and employment relations field beyond the B.S. degree. The undergraduate curriculum introduces students to:

1. the roles employers, employees, employee organizations and public policy makers play in the employment relationship,
2. the complex personal and organizational issues inherent in the employment relationship
3. the laws that form the legal framework for the employee-employer relationship, and
4. the tools needed to systematically analyze those complex issues and evaluate research relevant to those analyses.

The graduate curriculum provides for a more intensive, individualized, and focused examination of the human resources and employment relations field. It also provides an opportunity for students to explore a concentrated sub-area of the HRER field in depth. Upon completion of the integrated degree, students will have gained advanced knowledge and expertise from conducting and analyzing empirical work and participating in online classes that can be directly applied to the workplace.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students apply to the program via the Graduate School application for admission (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet the admission requirements of the Graduate School, as well as the admission requirements for the MHRER degree.

Admissions decisions for the B.S./MHRER program are based on the quality of the applicant's credentials. The decisions are made after a review of the complete application portfolio. The integrated B.S. /MHER program will be limited to highly talented undergraduates. Applicants to the integrated program:

- must be enrolled in the Labor and Human Resources B.S. program;
- must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG;
- must have an overall GPA of 3.4 (on a 4.0 scale) in undergraduate course work and a minimum GPA of 3.6 in the major;
- must present an approved plan of study (to be determined in consultation with the student's undergraduate adviser and the Graduate Director, and to be signed by both; the approved Plan of Study should be reviewed periodically with an adviser as the student advances through the program);
- One letter of recommendation that attests to the applicant's readiness.
- Short Answer Questions: Applicants will be asked to respond to the following 4 questions within the graduate application. The answers to these questions will allow the admissions committees to get to know more about the candidate, their goals, and experiences.
 - What are your short-term and long-term education/career goals and how do you expect this program to impact those goals?
 - Describe what attracted you to this program and how you think it will support your educational and professional aspirations.
 - Explain how you are prepared/preparing to succeed in a rigorous graduate program. Discuss your strategies and perceived challenges that you may have related to time management or other relevant factors.
 - Give an example of a time in which you received constructive criticism related to your work or study. What was it, who did it come from, and how did you apply it going forward?

No GRE or GMAT scores are required for admission to the program.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.S. in Labor and Human Resources are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). Degree requirements for the MHRER degree are listed on the Degree Requirements tab. To earn the Master of Human Resources and Employment Relations degree, students in the IUG program must complete all of the degree requirements for the MHRER degree.

12 credits at the 400, 500, or 800 level can apply to both undergraduate and graduate degrees. Students can choose which 12 credits will double-count for both the undergraduate and graduate degrees from the following list:

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
LHR 400	Comparative Employment Relations Systems	3
LHR 401	The Law of Labor-Management Relations	3
LHR 403	International Human Resource Studies	3
or HRER 803	Human Resources in Multinational Enterprises	
LHR 427	Understanding Business Processes for LHR Professionals	3
or HRER 825	Strategic Business Tools for HRER Professionals	
LHR 460	Ethics in the Workplace	3
HRER 501	Labor and Employment Law	3
HRER 504	Seminar in Employment Relations	3

A minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the MHRER degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Integrated B.S. in Labor and Human Resources and M.S. in Human Resources and Employment Relations

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Labor and Human Resources with the M.S. in Human Resources and Employment Relations offered at the following campuses:

Undergraduate Degree

- University Park
- World Campus

Graduate Degree

- University Park

The graduate portion of this IUG is currently offered as face-to-face residential instruction. While the undergraduate curriculum for this IUG may be completed at multiple campuses, the ease and feasibility of completing the integrated program may be heavily dependent upon the location of the graduate instruction. Please discuss the feasibility of completing the IUG with a representative for the graduate program before beginning the application process.

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The integrated Labor and Human Resources B.S. and HRER M.S. is a five-year program designed for academically talented baccalaureate students to obtain both the B.S. and the M.S. degrees in Labor and

Human Resources and HRER with five years of study. Students will develop expertise in the human resources and employment relations fields beyond the B.S. degree. The undergraduate curriculum educates students about:

1. the roles that employers, employees, employee organizations and public policy makers play in the employment relationship,
2. the complex personal and organizational issues inherent in the employment relationship
3. and how to systematically analyze those complex issues and evaluate research relevant to those analyses.

The graduate curriculum provides for more individualized, focused learning in a concentrated sub-area of the HRER field. The program culminates with a capstone course or thesis. Upon completion of the integrated degree, students will enter the workforce with advanced knowledge and expertise gained from conducting and analyzing empirical work and participating in seminar-style classes.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students apply to the program via the Graduate School application for admission (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet the admission requirements of the Graduate School, as well as the admission requirements for the Master of Science degree in HRER.

The number of openings in the integrated B.S./M.S. program will be limited to undergraduates with strong academic records. Applicants to the integrated program:

1. must be enrolled in the Labor and Human Resources B.S. program;
2. must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG;
3. must have an overall GPA of 3.2 (on a 4.0 scale) in undergraduate course work and a minimum GPA of 3.5 in the major;
4. must obtain letters of recommendation from the chairs of the Department's undergraduate and graduate committees; and
5. must submit a writing sample, 2 transcripts, 1 letter of recommendation (in addition to those from the chairs of the Department's undergraduate and graduate committees), and a career statement.

In consultation with an adviser, students must prepare a plan of study appropriate to this integrated program. Students must present their plan of study to the head of the graduate program or the appropriate committee overseeing the integrated program prior to being admitted to the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.

No GRE or GMAT scores are required for admission to the integrated program.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.S. in Labor and Human Resources are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). To earn the Master of Science degree in HRER, students in the IUG program must complete all of the degree requirements for the Master of Science described on the Degree Requirements tab.

Up to 15 credits may be applied to both undergraduate and graduate degree program requirements. Students can choose which 15 credits will double-count for both the undergraduate and graduate degrees from the following list:

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
LHR 400 or HRER 500	Comparative Employment Relations Systems Topics in Comparative Industrial Relations	3
LHR 401	The Law of Labor-Management Relations	3
LHR 403 or HRER 503	International Human Resource Studies Seminar in International Human Resources Studies	3
LHR 427 or HRER 825	Understanding Business Processes for LHR Professionals Strategic Business Tools for HRER Professionals	3
LHR 428 or HRER 824	Total Rewards Total Rewards	3
LHR 460	Ethics in the Workplace	3
HRER 501	Labor and Employment Law	3
HRER 502	Human Behavior at Work	3
HRER 504	Seminar in Employment Relations	3

A minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.S. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Integrated B.S. in Psychology and M.S. in Human Resources and Employment Relations

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Psychology with the M.S. in Human Resources and Employment Relations offered at the following campuses:

Undergraduate Degree

- University Park
- World Campus

Graduate Degree

- University Park

The graduate portion of this IUG is currently offered as face-to-face residential instruction. While the undergraduate curriculum for this IUG may be completed at multiple campuses, the ease and feasibility of completing the integrated program may be heavily dependent upon the location of the graduate instruction. Please discuss the feasibility of completing the IUG with a representative for the graduate program before beginning the application process.

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The integrated Psychology (PSYBS) B.S. and Human Resources and Employment Relations (HRER) M.S. is a five-year program designed for academically-talented undergraduate Psychology baccalaureate students to obtain both the B.S. degree in Psychology and the M.S. degree in HRER in an intense, accelerated program of study. Students will develop expertise in the human resources and employment relations field beyond that provided by their Psychology B.S. degree. The undergraduate psychology curriculum potentially introduces students to:

1. personnel selection,
2. training and development, and
3. organizational psychology.

The graduate curriculum provides for a more intensive, individualized, and focused examination of the human resources and employment relations field, including:

1. the roles employers, employees, employee organizations, and public policy makers play in the employment relationship,
2. the complex personal and organizational issues inherent in the employment relationship,
3. the laws that form the legal framework for the employee-employer relationship,
4. the tools needed to systematically analyze those complex issues and evaluate research relevant to those analyses, and
5. human resource management policies and practices that contribute to individual and organizational success.

It also provides an opportunity for students to explore a concentrated sub-area of the HRER field in depth. The program culminates with the student either completing a thesis or capstone course. Upon completion of the integrated degree, students will be well-positioned to assume positions of greater responsibility in Industrial/Organizational Psychology, Human Resource Management, Employment Relations, and related careers as a result of the advanced knowledge and expertise gained through the program.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students apply to the program via the Graduate School application for admission (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet the admission requirements of the Graduate

School, as well as the admission requirements for the Master of Science degree in HRER.

Admission decisions for the B.S. Psychology /M.S. Human Resources and Employment Relations program are based on the quality of the applicant’s credentials. The decisions are made after a review of the complete application portfolio. The integrated B.S./M.S. program will be limited to highly-talented undergraduates. Applicants to the integrated program:

- Must be enrolled in the PSYBS program, pursuing the Business Option, with the successful completion of PSYCH 281, and one of the following: PSYCH 482, PSYCH 484 or PSYCH 485
- Must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG;
- Must have an overall GPA of 3.2 (on a 4.0 scale) in undergraduate course work and a minimum GPA of 3.5 in the major;
- Must submit three letters of recommendation; and
- Must submit a writing sample, a resume, and a 2-3 page essay articulating career and educational goals that demonstrates the applicant’s written communication skills.

In consultation with an adviser, students must prepare a plan of study appropriate to this integrated program. Students must present their plan of study to the head of the graduate program or the appropriate committee overseeing the integrated program prior to being admitted to the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.

No GRE or GMAT scores are required for admission to the integrated program.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.S. in Psychology are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). To earn the Master of Science degree in HRER, students in the IUG program must complete all of the degree requirements for the Master of Science described on the Degree Requirements tab, with one exception. Students are not required to complete HRER 502 Human Behavior at Work. Instead, students will choose one additional 3-credit 500 or 800 level elective in consultation with their adviser.

Up to 15 credits may be applied to both undergraduate and graduate degree program requirements. Students can choose which 15 credits will double-count for both the undergraduate and graduate degrees from the following list:

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
One of the following:		3
PSYCH 484	Work Attitudes and Motivation	
PSYCH 485	Leadership in Work Settings	
PSYCH 482	Selection and Assessment in Organizations	
LHR 460	Ethics in the Workplace	3

HRER 500 or LHR 400	Topics in Comparative Industrial Relations Comparative Employment Relations Systems	3	Graduate Council policies listed under GCAC-300 Admissions Policies (https://gradschool.psu.edu/graduate-education-policies/).
HRER 501	Labor and Employment Law	3	Students apply to the program via the Graduate School application for admission (http://www.gradschool.psu.edu/prospective-students/how-to-apply/), and must meet the admission requirements of the Graduate School, as well as the admission requirements for the Master of Science degree in HRER.
HRER 503 or LHR 403	Seminar in International Human Resources Studies International Human Resource Studies	3	

A minimum of 50% of the double-counted courses must be at the 500 or 800-level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.S. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Integrated B.S. in Spanish and M.S. in Human Resources and Employment Relations

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Spanish with the M.S. in Human Resources and Employment Relations offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- University Park

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The integrated Spanish B.S. and HRER M.S. is a five-year program designed for highly qualified and motivated students seeking employment within a culturally diverse workplace. Students will develop basic skills in speaking, understanding, reading, and writing Spanish. Students will gain familiarity with Hispanic cultures through literature and the University's international education program, if they choose to have that experience. Students also will learn about:

1. the roles that employers, employees, employee organizations, and public policy makers play in the employment relationship,
2. the complex personal and organizational issues inherent in the employment relationship, and
3. how to systematically analyze those complex issues and evaluate research relevant to those analyses.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to

The number of openings in the integrated B.S./M.S. program will be limited to undergraduates with strong academic records. Applicants to the integrated program:

- must be enrolled in the Spanish B.S. Applied Spanish Option
- must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG;
- must have an overall GPA of 3.2 (on a 4.0 scale) in undergraduate course work and a minimum GPA of 3.5 in the major;
- must obtain letters of recommendation from the chairs of the Spanish undergraduate committee and the HRER graduate committee; and
- must submit a writing sample, 2 transcripts, 1 letter of recommendation (in addition to those from the chairs of the Department's undergraduate and graduate committees), and a career statement.

In consultation with an adviser, students must prepare a plan of study appropriate to this integrated program. Students must present their plan of study to the head of the graduate program or the appropriate committee overseeing the integrated program prior to being admitted to the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.

No GRE or GMAT scores are required for admission to the program.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.S. in Spanish are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.S. degree are listed on the Degree Requirements tab.

Up to 15 credits may be applied to both undergraduate and graduate degree program requirements. Students can choose which 15 credits will double-count for both the undergraduate and graduate degrees from the following list:

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
LHR 460	Ethics in the Workplace	3
HRER 500	Topics in Comparative Industrial Relations	3
HRER 501	Labor and Employment Law	3
HRER 502	Human Behavior at Work	3

HRER 503	Seminar in International Human Resources Studies	3
HRER 504	Seminar in Employment Relations	3

A minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.S. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

INTEGRATED B.A. IN COMMUNICATION ARTS AND SCIENCES AND M.S. IN HUMAN RESOURCES AND EMPLOYMENT RELATIONS

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.A. in Communication Arts and Sciences with the M.S. in Human Resources and Employment Relations offered at the following campuses:

Undergraduate Degree

- Berks
- Brandywine
- University Park

Graduate Degree

- University Park

The graduate portion of this IUG is currently offered as face-to-face residential instruction. While the undergraduate curriculum for this IUG may be completed at multiple campuses, the ease and feasibility of completing the integrated program may be heavily dependent upon the location of the graduate instruction. Please discuss the feasibility of completing the IUG with a representative for the graduate program before beginning the application process.

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The integrated Communication Arts and Sciences (CASBA) B.A. and Human Resources and Employment Relations (HRER) M.S. is a five-year program designed for academically-talented undergraduate Communication Arts and Sciences baccalaureate students to obtain both the B.A. degree in CAS and the M.S. degree in HRER in an intense, accelerated program of study. Students will develop expertise in the human resources and employment relations field beyond that provided by their CAS B.A. degree.

The undergraduate communication arts and sciences curriculum potentially introduces students to (1) fundamental facets of human

communication, (2) practical applications of communication research to organizational contexts, and (3) effective communication in personal, social, professional, and multicultural situations. The graduate curriculum provides for a more intensive, individualized, and focused examination of the human resources and employment relations field, including (1) the roles employers, employees, employee organizations, and public policy makers play in the employment relationship, (2) the complex personal and organizational issues inherent in the employment relationship, (3) the laws that form the legal framework for the employee-employer relationship, (4) the tools needed to systematically analyze those complex issues and evaluate research relevant to those analyses, and (5) human resource management policies and practices that contribute to individual and organizational success. It also provides an opportunity for students to explore a concentrated sub-area of the HRER field in depth, choosing between an HR and an ER option. The program culminates with the student either completing a thesis or capstone course. Upon completion of the integrated degree, students will be well-positioned to assume positions of greater responsibility in Communications, Human Resource Management, Employment Relations, and related careers as a result of the advanced knowledge and expertise gained through the program.

ADMISSION REQUIREMENTS

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students apply to the program via the Graduate School application for admission (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet the admission requirements of the Graduate School, as well as the admission requirements for the Master of Science degree in HRER.

Admission is selective based on criteria established by the leadership of LER and CAS. Though exceptions are possible, student applicants will generally have a minimum overall GPA of 3.5 in their major and have an overall GPA of 3.2 in undergraduate course work at the time of application (on a 4.0 scale). Applications for the program will be considered in the fall and spring semesters for admission to the program the following semester.

Applicants to the integrated program:

- Must be enrolled in the B.A. program in the Department of Communication Arts and Sciences
- Must have completed entrance to their undergraduate major and completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.
- Must provide a narrative statement explaining why they want to participate in this program and why they are qualified to do so.
- Must arrange for three letters of recommendation (at least one from a Department of Communication Arts and Sciences faculty member).
- Must submit a writing sample, a resume, and a 2-3 page essay articulating career and educational goals that demonstrates the applicant's written communication skills.

In consultation with an adviser, students must prepare a plan of study appropriate to this integrated program. Students must present their

plan of study to the head of the graduate program or the appropriate committee overseeing the integrated program prior to being admitted to the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.

No GRE or GMAT scores are required for admission to the program.

DEGREE REQUIREMENTS

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.A. in Communication Arts and Sciences are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). To earn the Master of Science degree in HRER, students in the IUG program must complete all the degree requirements for the Master of Science described on the Degree Requirements tab.

M.S. Requirements

Up to 15 credits may be applied to both undergraduate and graduate degree program requirements. Students can choose which 15 credits will double-count for both the undergraduate and graduate degrees from the following list:

Code	Title	Credits
COURSES ELIGIBLE TO DOUBLE COUNT FOR BOTH DEGREES		
CAS 403	Interpersonal Communication Theory and Research	3
CAS 404	Conflict Resolution and Negotiation	3
CAS 422	Contemporary African American Communication	3
CAS 426W	Communication Ethics	3
CAS 450W	Group Communication Theory and Research	3
CAS 452W	Organizational Communication Theory and Research	3
CAS 453	Health Communication Theory and Research	3
CAS 455	Topics in Gender and Communication	3
CAS 471	Intercultural Communication Theory and Research	3
CAS 483	Communication and Information Technology II	3
HRER 502	Human Behavior at Work	3
HRER 504	Seminar in Employment Relations	3
HRER 523	Seminar in Work-Life Dilemmas, Practices, and Policies	3
HRER 536	Diversity in the Workplace	3

A minimum of 50% of the double-counted courses must be at the 500 or 800-level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students must complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.S. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

INTEGRATED B.S. IN COMMUNICATION ARTS AND SCIENCES AND M.S. IN HUMAN RESOURCES AND EMPLOYMENT RELATIONS

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Communication Arts and Sciences with the M.S. in Human Resources and Employment Relations offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- University Park

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The integrated Communication Arts and Sciences (CASBS) B.S. and Human Resources and Employment Relations (HRER) M.S. is a five-year program designed for academically-talented undergraduate Communication Arts and Sciences baccalaureate students to obtain both the B.S. degree in CAS and the M.S. degree in HRER in an intense, accelerated program of study. Students will develop expertise in the human resources and employment relations field beyond that provided by their CAS B.S. degree.

The undergraduate communication arts and sciences curriculum potentially introduces students to (1) fundamental facets of human communication, (2) practical applications of communication research to organizational contexts, and (3) effective communication in personal, social, professional, and multicultural situations. The graduate curriculum provides for a more intensive, individualized, and focused examination of the human resources and employment relations field, including (1) the roles employers, employees, employee organizations, and public policy makers play in the employment relationship, (2) the complex personal and organizational issues inherent in the employment relationship, (3) the laws that form the legal framework for the employee-employer relationship, (4) the tools needed to systematically analyze those complex issues and evaluate research relevant to those analyses, and (5) human resource management policies and practices that contribute to individual and organizational success. It also provides an opportunity for students to explore a concentrated sub-area of the HRER field in depth, choosing between an HR and an ER option. The program culminates with the student either completing a thesis or capstone course. Upon completion of the integrated degree, students will be well-positioned to assume positions of greater responsibility in Communications, Human Resource Management, Employment Relations, and related careers as a result of the advanced knowledge and expertise gained through the program.

ADMISSION REQUIREMENTS

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students apply to the program via the Graduate School application for admission (<http://www.gradschool.psu.edu/prospective-students/how->

to-apply/), and must meet the admission requirements of the Graduate School, as well as the admission requirements for the Master of Science degree in HRER.

Admission is selective based on criteria established by the leadership of LER and CAS. Though exceptions are possible, student applicants will generally have a minimum overall GPA of 3.5 in their major and have an overall GPA of 3.2 in undergraduate course work at the time of application (on a 4.0 scale). Applications for the program will be considered in the fall and spring semesters for admission to the program the following semester.

Applicants to the integrated program:

- Must be enrolled in the B.S. program in the Department of Communication Arts and Sciences
- Must have completed entrance to their undergraduate major and completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.
- Must provide a narrative statement explaining why they want to participate in this program and why they are qualified to do so.
- Must arrange for three letters of recommendation (at least one from a Department of Communication Arts and Sciences faculty member).
- Must submit a writing sample, a resume, and a 2-3 page essay articulating career and educational goals that demonstrates the applicant's written communication skills.

In consultation with an adviser, students must prepare a plan of study appropriate to this integrated program. Students must present their plan of study to the head of the graduate program or the appropriate committee overseeing the integrated program prior to being admitted to the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.

No GRE or GMAT scores are required for admission to the program.

DEGREE REQUIREMENTS

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.S. in Communication Arts and Sciences are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). To earn the Master of Science degree in HRER, students in the IUG program must complete all the degree requirements for the Master of Science described on the Degree Requirements tab.

M.S. Requirements

Up to 15 credits may be applied to both undergraduate and graduate degree program requirements. Students can choose which 15 credits will double-count for both the undergraduate and graduate degrees from the following list:

Code	Title	Credits
COURSES ELIGIBLE TO DOUBLE COUNT FOR BOTH DEGREES		
CAS 403	Interpersonal Communication Theory and Research	3
CAS 404	Conflict Resolution and Negotiation	3
CAS 422	Contemporary African American Communication	3

CAS 426W	Communication Ethics	3
CAS 450W	Group Communication Theory and Research	3
CAS 452W	Organizational Communication Theory and Research	3
CAS 453	Health Communication Theory and Research	3
CAS 455	Topics in Gender and Communication	3
CAS 471	Intercultural Communication Theory and Research	3
CAS 483	Communication and Information Technology II	3
HRER 502	Human Behavior at Work	3
HRER 504	Seminar in Employment Relations	3
HRER 512	Research Methods and Analytics in Human Resources and Employment Relations	3
HRER 523	Seminar in Work-Life Dilemmas, Practices, and Policies	3
HRER 536	Diversity in the Workplace	3

A minimum of 50% of the double-counted courses must be at the 500 or 800-level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students must complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.S. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Joint Degrees

Joint J.D. / M.S. with Penn State Law

Requirements listed here are in addition to requirements listed in GCAC-211 Joint Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-211-joint-degree-programs/>).

Penn State Law and the Human Resources and Employment Relations graduate program (HRER) offer a joint degree program leading to a Juris Doctor (J.D.) and a Master of Science (M.S.) in Human Resources and Employment Relations.

Admission Requirements

The number of openings in the joint degree J.D./M.S. program will be limited to students with an outstanding academic record who have successfully completed the first-year curriculum (<https://pennstatelaw.psu.edu/academics/jd-program/>) at Penn State Law. Admissions requirements and applications for admission for Penn State Law are available at the J.D. Admissions (<https://pennstatelaw.psu.edu/penn-state-law-jd-admissions/>) section of the Penn State Law website.

Students apply to the joint degree program via the Graduate School application for admission (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet the admission requirements of the Graduate School, as well as the admission requirements for the Master of Science degree in HRER.

Applicants to the joint degree program:

- must have been admitted to Penn State Law;
- must have successfully completed the first-year curriculum at Penn State Law with a minimum grade point average of 3.0;
- must complete a plan of study, to be determined in consultation with the student's Law School Adviser and the Director of the HRER Graduate Program;
- must submit two letters of recommendations from Penn State Law faculty;
- must submit two transcripts from Penn State Law; and
- must submit a career statement outlining the student's objectives and reasons for applying to the program.

Please note that applicants to the J.D./M.S. HRER program are not required to submit GRE or GMAT scores.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the J.D. program are listed on the Penn State Law website (<https://pennstatelaw.psu.edu/academics/jd-program/>). Degree requirements for the M.S. degree in HRER are listed on the Degree Requirements tab.

If students accepted into the joint degree program are unable to complete the J.D. degree, they are still eligible to receive the M.S. degree if all the M.S. degree requirements have been satisfied.

Double-Counting of Credits

Penn State Law: Up to twelve (12) credits of relevant course work for the HRER graduate program can be double-counted towards the requirements for the J.D. degree. The only two HRER courses that will not be credited toward the J.D. degree are HRER 501 and HRER 510.

HRER: Up to twelve (12) credits of relevant course work from Penn State Law can be double-counted toward the degree requirements for the M.S. degree. The twelve credits can be chosen from the courses below:

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
LABR 962	The Employment Relationship	3
LABR 964	Employment Discrimination	3
LABR 965	Workers' Compensation Law	3
LABR 966	The Law of Employee Benefits	3
LABR 970	Labor Law	3

Advising

All students in the program will have two advisers, one from Penn State Law and one from the School of Labor and Employment Relations. Periodic interaction between the two advisers is encouraged. A program of study will be developed for each student, taking into account the fact that some courses at both locations are offered on a rotating or intermittent basis.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

graduate-education-policies/), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Human Resources and Employment Relations (HRER) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/hrer/>)

Learning Outcomes

Master of Human Resources and Employment Relations (M.H.R.E.R.)

1. **KNOW:** Graduates will have and be able to demonstrate the necessary advanced knowledge and competence in the fields of human resources and employment relations to excel in their careers.
2. **APPLY/CREATE:** Graduates will be able to recognize and analyze practical, legal, and ethical challenges related to HRER issues in domestic and global workplaces.
3. **COMMUNICATE:** Graduates will be able to conduct independent inquiries to identify current scholarship and best practices and effectively apply relevant theories and practices when solving problems in domestic and global workplaces.
4. **THINK:** Graduates will be able to interact effectively with other organizational leaders in helping to develop and implement organizational strategies in domestic and global workplaces.

5. **PROFESSIONAL PRACTICE:** Graduates will be able to effectively communicate knowledge of current topics in the fields both verbally and in writing to excel as HRER professionals.

Master of Science (M.S.)

1. **KNOW:** Students will have and be able to demonstrate the necessary advanced knowledge and competence in the fields to excel in ER and HRM careers.
2. **COMMUNICATE:** Students will be able to effectively communicate knowledge of current topics in the fields both verbally and in writing to excel as ER and HRM professionals.
3. **THINK:** Students will be able to recognize and analyze practical, legal, and ethical challenges related to ER and HRM issues in domestic and global workplaces.
4. **PROFESSIONAL PRACTICE:** Students will be able to respond appropriately to practical, legal, and ethical challenges in domestic and global workplaces using both theoretical and practical approaches of the field.
5. **APPLY/CREATE:** Students will be able to apply their knowledge by interacting effectively with other organizational leaders in helping to develop and implement organizational policies and strategies.

Contact

Campus	University Park
Graduate Program Head	Paul Clark
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Paul Clark
Program Contact	Erin Hetzel 506 Keller Building University Park PA 16802 eab27@psu.edu (814) 867-4167
Program Website	View (http://ler.la.psu.edu)

Campus	World Campus
Graduate Program Head	Paul Clark
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Brian Francis Redmond
Program Contact	Erin Hetzel 506 Keller Building University Park PA 16802 eab27@psu.edu (814) 867-4167
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/human-resources-and-employment-relations-masters/overview/)

Industrial Engineering

Graduate Program Head	Steven Landry
Program Code	IE
Campus(es)	University Park (Ph.D., M.S.) World Campus (M.Eng.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Master of Engineering (M.Eng.) Dual-Title Ph.D. and M.S. in Industrial Engineering and Operations Research
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=IE)

Graduate study and research are conducted in manufacturing, operations research-management science, production engineering, process design, systems engineering, human factors, ergonomics, service systems, and data analytics.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Graduates in engineering, physical sciences, and mathematics with a 3.00 grade-point average will be considered for admission. GRE scores are highly recommended for M.S. applicants only.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of Engineering (M.Eng.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The primary focus of the M.Eng. degree is not current students, but the thousands of IE alumni who are working as professional engineers and cannot easily take leave from their careers to return physically to the University Park campus for on-site courses and degrees. This degree provides an opportunity for these professionals to seek further education in the form of a professional graduate degree.

The requirements for the online M.Eng. degree program include:

1. Minimum of 30 course credits at the 400, 500, or 800 level, of which 21 course credits must be earned at Penn State (i.e. only 9 credits can be transferred from other institutions).
2. All students must successfully complete three credits of IE 894 (<https://bulletins.psu.edu/search/?P=IE%20894>) Capstone Design.

3. At least 18 credits in 500- or 800- level courses, with at least 6 at 500 level (including IE 894 (<https://bulletins.psu.edu/search/?P=IE%20894>)).
4. At least 15 credits in 500- level or 800-level IE courses (including IE 894 (<https://bulletins.psu.edu/search/?P=IE%20894>)).
5. At least 21 credits of IE courses (including IE 894 (<https://bulletins.psu.edu/search/?P=IE%20894>)).
6. The culminating experience for this professional degree will be satisfied with IE 894 (<https://bulletins.psu.edu/search/?P=IE%20894>), which includes a written report summarizing the analyses and designs used to solve a problem in their workplace submitted to the course instructor.

Continuous registration is required for all graduate students until the paper, thesis, or dissertation is approved.

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The M.S. degree program is intended for students to gain advanced knowledge for research, analysis, and design in industrial engineering. The M.S. degree is offered with thesis or research paper tracks, both requiring 32 credits. For both tracks, a core curriculum is required that is composed of IE 505 (<https://bulletins.psu.edu/search/?P=IE%20505>) and IE 511 (<https://bulletins.psu.edu/search/?P=IE%20511>), which all the students must satisfy.

The M.S. degree with thesis track requires 24 credits of course work and two credits of IE 590 (<https://bulletins.psu.edu/search/?P=IE%20590>). Out of the 24 credits of course work, at least 15 must be IE courses, and at least 12 must be at the 500 level. Of the 12 credits at the 500 level, at least nine must be IE courses. A thesis is required, for which six credits of IE 600 (<https://bulletins.psu.edu/search/?P=IE%20600>) or IE 610 (<https://bulletins.psu.edu/search/?P=IE%20610>) must be taken. The thesis must demonstrate comprehensive and in-depth knowledge of a topic in industrial engineering, and it should be suitable for submission for publication in a refereed journal as approved by the committee. The thesis must be accepted by the advisers and/ or committee members, the head of the graduate program, and the Graduate School.

The M.S. degree with non-thesis track requires 27 credits of course work, two credits of IE 590 (<https://bulletins.psu.edu/search/?P=IE%20590>). Out of the 27 credits of course work, at least 18 must be IE courses, and at least 18 must be at the 500 level. Of the 18 credits at the 500 level, at least fifteen must be IE courses. A scholarly paper is required for the M.S. degree with non-thesis track for which three credits of IE 596 (<https://bulletins.psu.edu/search/?P=IE%20596>) must be taken. The paper should demonstrate the ability of the student to integrate and apply concepts and techniques learnt in the courses to solve an engineering problem.

The students seeking the Master of Science degree in Industrial Engineering with non-thesis track are expected to start their degree in the Fall semester of every year and complete their degree including all the required course work and three credits of research resulting in a paper and graduate by the end of summer following the second semester. A research adviser will be assigned to students in their first semester. Students who need more time to complete the final paper will be allowed to complete the paper, and have it reviewed and approved after the third semester has ended. Students are not required to remain in residence while they complete the final paper. However, extensions granted to

students in this program must comply with the Graduate Council policy on deferred grades (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-400/gcac-401-grading-system/>). Non-thesis track students are typically not eligible for assistantships and therefore their plan of study is as follows:

- Fall semester: Twelve credits of course work, one credit of colloquium and one credit of research (IE 596 (<https://bulletins.psu.edu/search/?P=IE%20596>)).
- Spring semester: Twelve credits of course work, one credit of colloquium and one credit of research (IE 596 (<https://bulletins.psu.edu/search/?P=IE%20596>)).
- Summer semester: Three credits of course work and one credit of research (IE 596 (<https://bulletins.psu.edu/search/?P=IE%20596>)).

Continuous registration is required for all graduate students until the paper, thesis, or dissertation is approved.

An M.S. dual-title degree program in Industrial Engineering and Operations Research is also offered.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The Ph.D. program emphasizes scholarly research, and prepares students for research and development careers in industry, government, and academe. Official entrance into the Ph.D. program occurs upon successful completion of a written qualifying examination. The Ph.D. is awarded upon completion of a program of advanced study that includes a minimum period of residence, passing the English competence and comprehensive examinations, completing a satisfactory dissertation, and passing the final oral examination. To earn the Ph.D. degree, doctoral candidates must write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School. The degree requirements consist of 45 credits of course work and four IE 590 (<https://bulletins.psu.edu/search/?P=IE%20590>) credits. Of the 45 credits of required course work, 36 must be prefixed IE, and at least 30 must be at the 500 level. Nine credits must be from outside the Department and must include a six-credit sequence, with at least three credits at the 500 level. A Ph.D. dual-title degree program in Industrial Engineering and Operations Research is also available.

Continuous registration is required for all graduate students until the paper, thesis, or dissertation is approved.

Dual-Titles

Dual-Title M.S. and Ph.D. in Industrial Engineering and Operations Research

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Students must apply and be admitted to the graduate program in Industrial Engineering and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Operations Research dual-title program. Refer to the Admission Requirements section of the Operations Research

Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>). Doctoral students must be admitted into the dual-title degree program in Operations Research prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Industrial Engineering. In addition, students must complete the degree requirements for the dual-title in Operations Research, listed on the Operations Research Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Industrial Engineering and must include at least one Graduate Faculty member from the Operations Research program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Industrial Engineering and Operations Research. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of an Industrial Engineering and Operations Research dual-title Ph.D. student must include at least one member of the Operations Research Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Operations Research, the member of the committee representing Operations Research must be appointed as co-chair. The Operations Research representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Industrial Engineering and Operations Research. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)

- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

In addition, the following awards typically has been available to graduate students in this program:

Harold & Inge Marcus Graduate Fellowships

Consideration for these fellowships shall be given to students exhibiting academic excellence who have been admitted to Penn State as candidates for a graduate degree in the Department of Industrial and Manufacturing Engineering, College of Engineering.

Benjamin W. Niebel Manufacturing Fellowship

Consideration for this fellowship shall be given to students exhibiting academic excellence who have been admitted to Penn State as candidates for a graduate degree in the Department of Industrial and Manufacturing Engineering, College of Engineering.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Industrial Engineering (IE) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/ie/>)

Learning Outcomes

Master of Engineering (M.Eng.)

1. **KNOW:** Students will be able to describe how core principles and methods from selected sub-fields of Industrial Engineering apply to their profession.
2. **APPLY/CREATE:** Students will adapt and apply industrial engineering methods and techniques to effectively solve problems in the workplace.
3. **COMMUNICATE:** Students will proficiently articulate and concisely convey findings, analysis, and insights from industrial engineering projects in widely accessible language.
4. **THINK:** Students will be able to analyze workplace data to prepare a problem solution using common methods and techniques in Industrial Engineering.
5. **PROFESSIONAL PRACTICE:** Students will apply best practices and ethical standards for the industrial engineering profession.

Master of Science (M.S.)

1. **KNOW:** Students will be able to apply advanced core principles and methods from selected sub-fields of Industrial Engineering to a research problem.
2. **APPLY/CREATE:** Students will apply analytical skills gained through coursework to solve a research problem in industrial engineering.
3. **COMMUNICATE:** Students will adeptly articulate and succinctly present, both orally and in written form, research approaches and processes.
4. **THINK:** Students will survey methods and techniques in industrial engineering to design an effective problem-solving method.
5. **PROFESSIONAL PRACTICE:** Students will apply best practices and ethical standards in conducting research in industrial engineering.

Doctor of Philosophy (Ph.D.)

1. **KNOW:** Students will be able to identify appropriate resources to summarize what is known, contextualize their research, and identify gaps in knowledge.
2. **APPLY/CREATE:** Students will survey content from coursework and apply methods to solve research questions.
3. **APPLY/CREATE:** Students will develop a research question and propose a solution process to a committee of faculty.
4. **COMMUNICATE:** Students will adeptly articulate an original research question and succinctly present, both orally and in written form, their approach, analyses, findings, and conclusions.
5. **THINK:** Students will review and analyze existing research in industrial engineering to formulate a research problem and to create an effective methodology to address the problem.
6. **PROFESSIONAL PRACTICE:** Students will apply best practices and ethical standards to advance research in the industrial engineering profession.

Contact

Campus	University Park
Graduate Program Head	Steven James Landry
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Ling Rothrock
Program Contact	Lisa Kaye Fuoss 344 Leonhard Building University Park PA 16802 lkf1@psu.edu (814) 863-1269
Program Website	View (http://www.ime.psu.edu/)
Campus	World Campus
Graduate Program Head	Steven James Landry
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Ling Rothrock
Program Contact	310 Leonhard Building University Park PA 16802
Program Website	View (https://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-industrial-engineering-masters-degree/overview/)

Informatics

Graduate Program Head	Carleen Maitland
Program Code	INMAC
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Dual-Title Ph.D. in Informatics and Social Data Analytics Integrated B.S. in Information Sciences and Technology and M.S. in Informatics Integrated B.S. in Security and Risk Analysis and M.S. in Informatics
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=INMAC)

The Ph.D. in Informatics offers advanced graduate education for students contemplating careers in academic teaching and research, or research in a non-academic setting. The program is interdisciplinary in nature and expects scholarship at the highest level exhibiting depth of competency in at least one of the core areas of informatics, and an understanding of the integration of the critical constructs that drive the field: people, information, and technology.

The Dual-Title Ph.D. in Informatics and Social Data Analytics degree program is administered by the Social Data Analytics Committee, which is responsible for the management of the program. The committee maintains program definition, identifies faculty and courses appropriate to the program, and recommends policy and procedures for its operation to the Dean of the Graduate School. The program enables students from diverse graduate programs to attain and be identified with an interdisciplinary array of tools, techniques, and methodologies for social data analytics, while maintaining a close association with a home discipline. Social data analytics is the integration of social scientific, computational, informational, statistical, and visual analytic approaches to the analysis of large or complex data that arise from human interaction.

The Master of Science in Informatics is an interdisciplinary degree program that focuses on the theoretical, application-oriented, and educational issues facing a digital, global economy. The program is designed to build an understanding of how information and technology fundamentally impact (and are impacted by) people, organizations, and the world community. Topical areas within the program span a broad range including: human computer interaction, computational techniques, applications (e.g., bio-informatics and geographical information systems), societal issues (such as digital divide issues), user issues (e.g., computer-aided cognition), and information systems design and development providing exposure and grounding in many of the aspects of the information sciences. The program is especially attractive to students interested in gaining state-of-the-art understanding of informatics and its use as a solution in multiple venues.

The Integrated Undergraduate Graduate (IUG) program is available for strong undergraduate students who wish to pursue a bachelor's and master's degree in a shorter period of time than would be necessary if the degrees were pursued separately. There are two approved IUG programs: an Integrated B.S. in Information Sciences and Technology and M.S. in

Informatics, and an Integrated B.S. in Security and Risk Analysis and M.S. in Informatics.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Applicants to the program are required to submit three letters of reference, a current resume (including present position and any publications), a 1 to 3 page statement of research background and goals related to pursuing an advanced degree and career in informatics, which also briefly discusses personal motivation for obtaining an M.S. or Ph.D., and a sample of the applicant's writing (e.g., technical paper, etc.).

Because the program is multidisciplinary in nature, students from many different disciplines may be accepted for entry into the program. A bachelor's degree in a related area (e.g., engineering and science), while not necessary for admission, is helpful in the successful completion of the degree. It is expected that students will have a basic level of competency in statistics, as well as computer and information technology. Related work experience can be used to demonstrate such competency. A student may be accepted into the program with provisional status (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/provisional-admission/>) for no more than one year while work is completed to meet these expectations.

It is expected that the successful applicant will have an overall grade point average of 3.00 (on a 4.00 scale) or higher for his or her undergraduate study and/or graduate-level study. However, accomplishments demonstrated through work experience and recommendation letters from the applicant's academic adviser or employer will also play an important role in making the admission decision. The most qualified applicants will be accepted into the program until all spaces for new students are filled.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The M.S. in Informatics requires a minimum of 30 credits at the 400, 500, 600, or 800 level, with at least 18 credits at the 500 or 600 series combined; 27 of the 30 credits must be earned at Penn State. 600 and 610 thesis research courses are only for students completing the thesis culminating experience. 602 will not be counted in fulfilling any specific credit requirement for an advanced degree. These 30 credits are distributed among the following requirements:

Core Courses (3-6 credits)

All candidates are expected to develop a broad understanding of the core constructs of people, information, technology, and the significant

interactions among those elements by taking IST 504. Candidates may also take IST 505 to gain a deeper understanding of research design.

Specialization Courses (12-18 credits)

In consultation with his/her adviser, a candidate is expected to choose courses in one or more areas customized to support the thesis or scholarly paper. In addition to advanced courses in IST, a support area could be in cybersecurity, data science, law, business, education, engineering, the liberal arts, science, or any area that is linked to the information sciences. A list of suggested specialization courses is maintained by the graduate program office.

Research Methods (6 credits)

All candidates must develop a basic understanding of the research methods utilized in the information sciences, by taking at least two research methods courses offered in IST or elsewhere. The focus of the course must be on the methods being learned rather than application of some method to a research topic. A list of courses that will satisfy this requirement is maintained by the graduate program office.

Thesis or Scholarly paper (3-6 credits)

Students may choose a thesis or scholarly paper option. Students who choose the thesis option must register for 6 credits of IST 600 or IST 610, write a satisfactory thesis accepted by the master's committee, the head of the graduate program, and the Graduate School, and pass a thesis defense. The thesis should focus on a well-defined problem relevant to the information sciences. Students who choose the thesis option must also complete IST 505. Students who choose the scholarly paper option must register for 3 credits of IST 594 and complete the scholarly paper. The scholarly paper will be a focused piece of technical work that applies the student's expertise and knowledge base, and that is documented and presented as a scholarly paper report. Students who choose the scholarly paper option must complete at least 18 credits at the 500 level.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The doctoral degree in Informatics requires a minimum of 32 credits, including 14 credits of foundational courses and 18 credits of research and specialization courses in consultation with the student's adviser to support research progress.

Code	Title	Credits
Required Courses		
IST 501	Interdisciplinary Research Design for Information Sciences and Technology	3
IST 590	Colloquium	2
Select 9 credits from the program-maintained list of foundational courses.		9
Select 18 credits of research methodology and specialization courses in consultation with your adviser to support progress on your dissertation research.		18
Total Credits		32

To complete a Ph.D. degree, students must in their first semester take the 3-credit introduction to interdisciplinary research methods course (IST 501) and one credit of graduate colloquium (IST 590). In their second semester, students must take a second credit of graduate colloquium. During their first two semesters, students must complete a selection of three foundational courses that provide interdisciplinary perspectives on

research, a focus in the Qualifying Exam that takes place at the end of the first year.

As a complement to these first-year requirements, doctoral students must complete 18 credits of research methodology and specialization courses selected to increase proficiency in methods and topics relevant to their doctoral research agenda.

Finally, all students must be competent in the English language, with demonstrated skills in the communication of ideas both verbally and in writing commensurate with the requirement of scholarly and professional work. The Qualifying Examination will be used as an occasion to assess English proficiency and may result in a plan for remediation (including additional courses, mentoring, or experiences) for all students. Students must have completed 18 graduate credits before taking the Qualifying Exam and must pass the exam within three semesters. Students must pass the Ph.D. Comprehensive Examination after completion of most of their course work, usually after the student's second year in the program. A research-based dissertation must be completed under the direction of the Ph.D. committee, with the student submitting a dissertation proposal and defending that proposal in the defense examination. To earn the Ph.D. degree, doctoral students must write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School, and the student must pass a final oral examination (the dissertation defense).

Degree Requirements

Dual-Title Ph.D. in Informatics and Social Data Analytics

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

For the Dual-Title Ph.D. in Informatics and Social Data Analytics, students must apply and be admitted to the Informatics graduate program and The Graduate School before they can apply for admission to the dual-title degree program. Applicants interested in the dual-title degree program may make their interest in the program known on their applications to Informatics and include remarks in their statement of purpose that address the ways in which their research and professional goals in Informatics reflect an expanded interest in Social Data Analytics. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Social Data Analytics dual-title program.

To be enrolled in the dual-title doctoral degree program in Social Data Analytics, a student must submit a letter of application and transcript, which will be reviewed by the Social Data Analytics Admissions Committee. An applicant must have a minimum grade point average of 3.0 (on a 4-point scale) to be considered for enrollment in the dual-title degree program. Students must be admitted into the dual-title degree program in Social Data Analytics no later than the end of the fourth semester (not counting summer semesters) of entry into the primary Ph.D. program and before taking the comprehensive exam.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the Ph.D. in Informatics. In addition, students must complete the degree requirements for the dual-title in Social Data Analytics, listed on the Social Data Analytics Bulletin page (p. 641).

The qualifying examination in Informatics satisfies the qualifying exam requirement for the dual-title degree program in Social Data Analytics.

The Ph.D. committee must conform to all requirements of the primary graduate program and the Graduate Council. In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Social Data Analytics dual-title doctoral degree student must include at least one member of the Social Data Analytics Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Social Data Analytics, the member of the committee representing Social Data Analytics must be appointed as co-chair.

The dual-title degree will be guided by the comprehensive exam procedure of the primary graduate program. After completion of required course work, doctoral students in the dual-title doctoral degree program must pass a comprehensive examination. In programs where this includes evaluation of a written exam, the Social Data Analytics representative on the student's Ph.D. committee will participate in the writing and evaluation of the exam, in accordance with procedures maintained by the primary graduate program. In programs where the comprehensive exam involves defense of a dissertation prospectus, the Social Data Analytics representative on the student's Ph.D. committee will participate in the evaluation of the prospectus, including ensuring the proposed dissertation has substantial Social Data Analytics content.

Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. Students enrolled in the dual-title program are required to write and orally defend a dissertation on a topic that reflects their original research and education in Informatics and Social Data Analytics. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Integrated Undergrad-Grad Programs

Integrated B.S. in Information Sciences and Technology and M.S. in Informatics

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Information Sciences and Technology with the M.S. in Informatics offered at the following campuses:

Undergraduate Degree

- Harrisburg
- University Park
- World Campus

Graduate Degree

- University Park

The graduate portion of this IUG is currently offered as face-to-face residential instruction. While the undergraduate curriculum for this IUG may be completed at multiple campuses, the ease and feasibility of completing the integrated program may be heavily dependent upon the location of the graduate instruction. Please discuss the feasibility of completing the IUG with a representative for the graduate program.

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs

(<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The first two to three years of undergraduate course work follow the same undergraduate curriculum that other students follow in the Information Sciences and Technology major. Information Sciences and Technology undergraduates may apply for admission to the IUG program no earlier than February 15th of their second undergraduate year and no later than February 15 of their third undergraduate year after completing a minimum of 60 credits, if they meet the following admission requirements:

1. Must be enrolled in a College of IST undergraduate degree program.
2. Must have completed entrance to their undergraduate major and must have completed 60 credits of an IST undergraduate degree program. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.
3. Must apply to the IUG program by February 15 of their third undergraduate year.
4. Must apply to and be accepted without reservation into the Graduate School and M.S. program in Informatics.

Students must complete the Graduate School application (<http://www.gradschool.psu.edu/apply/?CFID=4347157&CFTOKEN=809212809140639-22E9BF85-AF21-D9DA-933F35E90FB10EAB&jsessionid=84304e7b7ae255ec9a524e5b1e591250183e>). Admission requirements for the M.S. in Informatics are listed on the Admission Requirements tab.
5. Must have an overall GPA of 3.5 (on a 4.0 scale) in undergraduate course work and a minimum GPA of 3.5 in all course work completed for the major.
6. Must present an approved plan of study. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser.
7. Must present two letters of recommendation from faculty members.
8. Must meet with both the Director of Undergraduate Academic Affairs and the Graduate Program Coordinator to declare interest and receive information about the IUG program.

Students must fulfill all degree requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Science in Information Sciences and Technology are listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>). Degree requirements for the Master of Science in Informatics degree are listed on the Degree Requirements tab. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.S. degree, they are still eligible

to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted. The required 3 credits of IST 504 will apply to both the graduate program and the undergraduate program. Students may choose an additional 9 credits to double-count for both the undergraduate and graduate degrees from the following:

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
IST 411	Distributed-Object Computing	3
IST 412	The Engineering of Complex Software Systems	3
IST 413	Usability Engineering	3
IST 420	Fundamentals of Systems and Enterprise Integration	3
IST 421	Advanced Enterprise Integration: Technologies and Applications	3
IST 431	The Information Environment	3
IST 432	Legal and Regulatory Environment of Information Science and Technology	3
IST 504	Foundations of Theories and Methods of Information Sciences and Technology Research	3
IST 505	Foundations of Research Design in Information Sciences and Technology	3

Integrated B.S. in Security and Risk Analysis and M.S. in Informatics

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Security and Risk Analysis with the M.S. in Informatics offered at the following campuses:

Undergraduate Degree

- Altoona
- Berks
- Harrisburg
- University Park
- World Campus

Graduate Degree

- University Park

The graduate portion of this IUG is currently offered as face-to-face residential instruction. While the undergraduate curriculum for this IUG may be completed at multiple campuses, the ease and feasibility of completing the integrated program may be heavily dependent upon the location of the graduate instruction. Please discuss the feasibility of completing the IUG with a representative for the graduate program.

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The Integrated Undergraduate Graduate (IUG) program is available for strong undergraduate students who wish to pursue a bachelor's and master's degree in a shorter period of time than would be necessary if the degrees were pursued separately.

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The first two to three years of undergraduate course work follow the same undergraduate curriculum that other students follow in the Security and Risk Analysis major. Security and Risk Analysis undergraduates may apply for admission to the IUG program no earlier than February 15th of their second undergraduate year and no later than February 15 of their third undergraduate year after completing a minimum of 60 credits, if they meet the following admission requirements:

1. Must be enrolled in a College of IST undergraduate degree program.
2. Must have completed entrance to their undergraduate major and must have completed 60 credits of an IST undergraduate degree program. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.
3. Must apply to the IUG program by February 15 of their third undergraduate year.
4. Must apply to and be accepted without reservation into the Graduate School and M.S. program in Informatics. Students must complete the Graduate School application (<http://www.gradschool.psu.edu/apply/?CFID=4347157&CFTOKEN=809212809140639-22E9BF85-AF21-D9DA-933F35E90FB10EAB&sessionId=84304e7b7ae255ec9a524e5b1e591250183e>). Admission requirements for the M.S. in Informatics are listed on the Admission Requirements tab.
5. Must have an overall GPA of 3.5 (on a 4.0 scale) in undergraduate course work and a minimum GPA of 3.5 in all course work completed for the major.
6. Must present an approved plan of study. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser.
7. Must present two letters of recommendation from faculty members.
8. Must meet with both the Director of Undergraduate Academic Affairs and the Graduate Program Coordinator to declare interest and receive information about the IUG program.

Students must fulfill all degree requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Science in Security and Risk Analysis are listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>). Degree requirements for the Master of Science in Informatics degree are listed on the Degree Requirements tab. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.S. degree, they are still eligible

to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted. The required 3 credits of IST 504 will apply to both the graduate program and the undergraduate program. Students may choose an additional 9 credits to double-count for both the undergraduate and graduate degrees from the following:

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
IST 451	Network Security	3
IST 452	Legal and Regulatory Environment of Privacy and Security	3
IST 454	Computer and Cyber Forensics	3
IST 504	Foundations of Theories and Methods of Information Sciences and Technology Research	3
IST 505	Foundations of Research Design in Information Sciences and Technology	3
SRA 433	Deception and Counterdeception	3
SRA 468	Spatial Analysis of Risks	3
SRA 471	Informatics, Risk, and the Post-Modern World	3

Integrated B.S. in Cybersecurity Analytics and Operations and M.S. in Informatics

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Cybersecurity Analytics and Operations with the M.S. in Informatics offered at the following campuses:

Undergraduate Degree

- Abington
- Altoona
- Beaver
- Bers
- Brandywine
- Greater Allegheny
- Harrisburg
- Lehigh Valley
- Schuylkill
- Shenango
- University Park
- World Campus
- York

Graduate Degree

- University Park

The graduate portion of this IUG is currently offered as face-to-face residential instruction. While the undergraduate curriculum for this IUG may be completed at multiple campuses, the ease and feasibility of completing the integrated program may be heavily dependent upon the location of the graduate instruction. Please discuss the feasibility of completing the IUG with a representative for the graduate program.

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The first two to three years of undergraduate course work follow the same undergraduate curriculum that other students follow in the Cybersecurity Analytics and Operations major. Cybersecurity Analytics and Operations undergraduates may apply for admission to the IUG program no earlier than February 15th of their second undergraduate year and no later than February 15 of their third undergraduate year after completing a minimum of 60 credits, if they meet the following admission requirements:

1. Must be enrolled in a College of IST undergraduate degree program.
2. Must have completed entrance to their undergraduate major and must have completed 60 credits of an IST undergraduate degree program. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.
3. Must apply to the IUG program by February 15 of their third undergraduate year.
4. Must apply to and be accepted without reservation into the Graduate School and M.S. program in Informatics. Students must complete the Graduate School application (<http://www.gradschool.psu.edu/apply/>). Admission requirements for the M.S. in Informatics are listed on the Admissions Requirements tab.
5. Must have an overall GPA of 3.5 (on a 4.0 scale) in undergraduate course work and a minimum GPA of 3.5 in all course work completed for the major.
6. Must present an approved plan of study. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser.
7. Must present two letters of recommendation from IST faculty members.
8. Must meet with both the Director of Undergraduate Academic Affairs and the Graduate Program Coordinator to declare interest and receive information about the IUG program.

Students must fulfill all degree requirements for each degree to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Science in Cybersecurity Analytics and Operations are listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>). Degree requirements for the Master of Science in Informatics degree are listed on the Degree Requirements tab. Students must sequence their courses, so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.S. degree, they are still eligible to receive

their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted. The required 3 credits of IST 504 will apply to both the graduate program and the undergraduate program. Students may choose an additional 9 credits to double-count for both the undergraduate and graduate degrees from the following:

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
IST 432	Legal and Regulatory Environment of Information Science and Technology	3
IST 451	Network Security	3
IST 454	Computer and Cyber Forensics	3
IST 456	Information Security Management	3
IST 504	Foundations of Theories and Methods of Information Sciences and Technology Research	3
<i>One of the following, based on concentration:</i>		
IST 521	Human-Computer Interaction: The User and Technology	3
IST 554	Network Management and Security	3
IST 557	Data Mining: Techniques and Applications	3
IST 815	Foundations of Information Security and Assurance	3

Integrated B.S. in Human-Centered Design and Development and M.S. in Informatics

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Human-Centered Design and Development with the M.S. in Informatics offered at the following campuses:

Undergraduate Degree

- Harrisburg
- University Park

Graduate Degree

- University Park

The graduate portion of this IUG is currently offered as face-to-face residential instruction. While the undergraduate curriculum for this IUG may be completed at multiple campuses, the ease and feasibility of completing the integrated program may be heavily dependent upon the location of the graduate instruction. Please discuss the feasibility of completing the IUG with a representative for the graduate program.

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to

Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The first two to three years of undergraduate course work follow the same undergraduate curriculum that other students follow in the Human-Centered Design and Development major. Human-Centered Design and Development undergraduates may apply for admission to the IUG program no earlier than February 15th of their second undergraduate year and no later than February 15 of their third undergraduate year after completing a minimum of 60 credits, if they meet the following admission requirements:

1. Must be enrolled in a College of IST undergraduate degree program.
2. Must have completed entrance to their undergraduate major and must have completed 60 credits of an IST undergraduate degree program. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.
3. Must apply to the IUG program by February 15 of their third undergraduate year.
4. Must apply to and be accepted without reservation into the Graduate School and M.S. program in Informatics. Students must complete the Graduate School application (<http://www.gradschool.psu.edu/apply/>). Admission requirements for the M.S. in Informatics are listed on the Admissions Requirements tab.
5. Must have an overall GPA of 3.5 (on a 4.0 scale) in undergraduate course work and a minimum GPA of 3.5 in all course work completed for the major.
6. Must present an approved plan of study. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser.
7. Must present two letters of recommendation from IST faculty members.
8. Must meet with both the Director of Undergraduate Academic Affairs and the Graduate Program Coordinator to declare interest and receive information about the IUG program.

Students must fulfill all degree requirements for each degree to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Science in Human-Centered Design and Development are listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>). Students must sequence their courses, so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.S. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted. The required 3 credits of IST 504 will apply to both the graduate program and the undergraduate program.

Students may choose an additional 9 credits to double-count for both the undergraduate and graduate degrees from the following:

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
IST 402	Emerging Issues and Technologies	3
IST 411	Distributed-Object Computing	3
IST 412	The Engineering of Complex Software Systems	3
IST 504	Foundations of Theories and Methods of Information Sciences and Technology Research	3
IST 505	Foundations of Research Design in Information Sciences and Technology	3
IST 543	Foundations of Software Security	3
IST 815	Foundations of Information Security and Assurance	3
IST 820	Cybersecurity Analytics	3

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Information Sciences and Technology (IST) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/ist/>)

Learning Outcomes

1. **KNOW:** Demonstrate appropriate breadth and depth of interdisciplinary knowledge, and comprehension of the major issues in information sciences and technology (IST).
2. **APPLY/ CREATE:** Use interdisciplinary knowledge and methods of IST to plan and conduct a research thesis.
3. **COMMUNICATE:** Communicate the major issues of IST effectively, including publications in high quality journals and presentations at high value conferences.
4. **THINK:** Demonstrate analytical and critical thinking within IST, including across disciplines.
5. **PROFESSIONAL PRACTICE:** Know and conduct themselves in accordance with the highest ethical standards, values, and, where these are defined, the best practices of IST (as expressed in SARI training modules).

Contact

Campus	University Park
Graduate Program Head	Carleen Maitland
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Dongwon Lee
Program Contact	Jenna Hart jns5431@psu.edu (814) 867-5787
Program Website	View (https://ist.psu.edu/prospective/graduate/ms-informatics/)

Information Science

Graduate Program Head	Raghu Sangwan
Program Code	INSC
Campus(es)	Great Valley (M.S.) World Campus (M.S.)
Degrees Conferred	Master of Science (M.S.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=INSC)

The Master of Science in Information Science at Penn State Great Valley is a well-rounded computing and IT degree, which addresses the multifaceted challenges IT professionals face every day, from analyzing data to developing web applications and managing IT staff and projects. The program offers a balance of information systems and management theories. This program is STEM designated.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students who have a baccalaureate degree in information systems, information science or other quantitative, scientific, or business discipline and those with experience in information technology will be considered for admission to the program. Students should have earned at least a 3.00 junior/senior average (on a 4.00 scale) in their baccalaureate

program. Although not required, scores from the Graduate Record Examinations (GRE) or the Graduate Management Admissions Test (GMAT) will be considered by the admissions committee if submitted. If the admissions committee determines an area of weakness or insufficient baccalaureate preparation, the student may be required to take one or both pre-program requirement courses (IST 441 and SWENG 400). Pre-program requirements do not count toward the 33-credit program total.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The requirement for the degree is 33 credits at the 400, 500, or 800 level (with least 18 credits at the 500 level), consisting of 18 credits of required core courses, 12 credits approved electives, selected from a list of approved courses maintained by the graduate program office with the assistance of a graduate adviser, followed by an integrative research topics course, which includes completion of a scholarly paper.

Code	Title	Credits
Required Courses		
INSC 831	Contemporary Information Systems Architecture	3
INSC 539	Information Science Emerging Topics	3
SWENG 545	Data Mining	3
INSC 526	Business Process Management and Integration	3
INSC 561	Web Security and Privacy	3
SWENG 568	Enterprise Integration	3
Electives		
12 credits of approved electives		12
Culminating Experience		
INSC 594	Research Topics (Scholarly Paper)	3
Total Credits		33

A grade-point average of at least 3.0 must be achieved, with at least 18 credits at the 500 level. Students lacking adequate preparation may be required to take one pre-program requirement course (IST 140 or equivalent). The pre-program requirement does not count toward the 33-credit program total.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Refer to the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students in this program are not eligible for graduate assistantships.

Financial aid for students in on-campus programs is in the form of student loans and a limited number of small scholarships, as described on the Penn State Great Valley website (<https://greatvalley.psu.edu/tuition-and-financial-aid/>).

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Information Science (INSC) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/insc/>)

Learning Outcomes

1. KNOW: Graduates will be able to understand the information needs of organizations and identify optimal IT solutions.
2. APPLY: Graduates will be able to apply known and emerging information systems theories and principles to improve and enhance deployed IT solutions
3. APPLY: Graduates will design and maintain practically viable solutions to support information retrieval, data analysis, and decision-making
4. COMMUNICATE: Graduates will be able to effectively communicate their technical perspective solutions to diverse audience.
5. THINK: Graduates will be able to identify the security concerns of and determine effective protection solutions to organizational information assets
6. PROFESSIONAL PRACTICE: Graduates will demonstrate knowledge of and ability to practice the professional standards of IT professional behavior.

Contact

Campus	Great Valley
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Guanghua Qiu
Program Contact	Sharon V. Patterson Penn State Great Valley 30 East SWedesford Road Malvern PA 19355 svp40@psu.edu (610) 648-3318
Program Website	View (http://greatvalley.psu.edu/academics/masters-degrees/information-science/)

Campus	World Campus
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Guanghua Qiu
Program Contact	Sharon V. Patterson svp40@psu.edu (610) 648-3318

Information Systems

Graduate Program Head	John Haddad
Program Code	INFSY
Campus(es)	Harrisburg (M.S.)
Degrees Conferred	Master of Science (M.S.) Integrated B.S. in Information Systems and M.S. in Information Systems
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=INFSY)

The Master of Science in Information Systems (MSIS) is a STEM-designated program that equips students with business intelligence, analytics, and management competencies required to shape business strategy and lead digital transformation to stay competitive.

A STEM-designated degree allows eligible graduates an Optional Practical Training (OPT) extension for up to 36 months, helping graduates gain additional real-world skills and experiences.

The MSIS is highly flexible to accommodate both full- and part-time students. To provide flexibility for students, some courses are also offered online or in a hybrid format (i.e., a blend of resident instruction and online). Students should contact the program office for information on specific semester course offerings.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Admission decisions are based primarily on undergraduate junior-senior grade-point average and the Graduate Management Admissions Test (GMAT) scores or Graduate Record Exam (GRE) scores. Post-baccalaureate course work, professional experience, and the statements provided in the application are also taken into account.

Students are also required to submit the following:

- a completed Graduate School application (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>) with application fee
- official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>);
- official scores from the GMAT test or GRE test (the test must have been taken within the past five years); and
- letters of recommendation (optional)

Application Dates

Candidates may enter the program at the beginning of the fall, spring, or summer session. To allow time for applications to be processed, all information, including GMAT or GRE score, must be received by Graduate Enrollment Services no later than:

- July 18 for admission to the fall semester
- November 18 for admission to the spring semester, and
- April 18 for admission to the summer session.

Applicants from outside the United States must follow the early admission dates in order to allow the necessary clearances and paperwork to be processed in time. International application deadline dates are:

- Fall Semester–May 31
- Spring Semester–September 30
- Summer Session–February 28

To be considered for a graduate assistantship, applicants must submit a complete application by March 1.

Entry Requirements

Credits obtained to fulfill entry and pre-program requirements cannot be applied towards the requirements for the degree.

Analytic Skills Requirement

Prior to enrolling in their M.S.I.S. course work, students are required to demonstrate competence in Analytic skills. This requirement may be demonstrated by:

1. satisfactory completion of college-level mathematics course or
2. successful completion of a mathematics proficiency examination approved by the M.S.I.S. program. This requirement must be taken either during the first semester or summer session before the student's matriculation and completed with a grade of C or better.

Computer Skills Requirement

Students are required to demonstrate proficiency in the use of computer applications. This requirement can be satisfied through completion of a college-level computer applications or information systems course within the past five years with a grade of B or higher or by documented significant computer-related work experience. If this requirement has not been met prior to admission, a college-level computer-based information systems course such as MIS 204 is required. Course work must be taken

either during the first semester or summer session before the student's matriculation and completed with a grade of B or higher.

Communication Skills Requirement

Successful completion of the M.S.I.S. program requires the ability to think clearly and to write and speak persuasively. Part of this requirement can be met by obtaining a score of "4" or more on the Graduate Management Admission Test (GMAT) or Graduate Record Exam (GRE) Analytical Writing Assessment (AWA). If this score is not achieved, students must satisfy this requirement through additional course work in writing skills or other work developed in consultation with the M.S.I.S. Program. This requirement must be satisfied during the first semester or summer session before the student's matriculation and completed with a grade of B or higher. The speech component of this requirement is satisfied through individual and group presentations in courses in the M.S.I.S. Program.

Pre-Program Requirement

The Pre-program requirement provides a basic foundation in theory, tools and techniques required for the management of profit and non-profit organizations. It also provides a basic understanding of applications of financial accounting, the creation and distribution of goods and services, business and how people relate to others in various organizations, helping to merge two related disciplines: business and information systems. Students who have completed the appropriate pre-program courses previously must have completed the courses with a grade of B or higher within seven years prior to admission, or through equivalent graduate course work completed with a B or higher within seven years prior to admission or college level course work validated by recent work experience. Students who have not met these tests of relevancy, grade, or currency prior to admission to the program must take these courses at the graduate level and early in program.

Code	Title	Credits
Pre-Program Requirement		
BUS 505	Data Analysis for Business Decisions	3
Select 6 credits from the following:		6
ACCT 501	Financial Statement Analysis	
BUSEC 502	Economics for Managers	
MNGMT 511	Organizational Behavior	
Total Credits		9

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The M.S.I.S. degree program requires, excluding pre-program requirements, 30 credits of course work at the 500 or 800 level, with a minimum of 18 credits at the 500 level.

Code	Title	Credits
Required Courses		
INFSY 535	Object-Oriented Design and Programming in Business	3
INFSY 540	Information Technology and Knowledge Management	3
15 credits of Information Systems courses from an approved list available in the program office		15

Electives

6 credits of electives from the 500-level courses offered by Penn State Harrisburg's School of Business Administration	6
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Culminating Experience

INFSY 554 Master's Project ¹	3
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Total Credits	30
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¹ The INFSY 554 Master's Project course involves development of an original master's project in the student's field of interest and preparation of a scholarly paper.

Data Analytics Track

The objective of this Track is to provide the student with business intelligence and analytics skills that enable them to gain insights and transform data into strategic decisions.

In consultation with their adviser, a student shall select 9 credits of the following:

Code	Title	Credits
BUS 510	Business Analytics and Decision Modeling	3
INFSY 555	Data Management Systems	3
INFSY 556	Data Warehousing	3
INFSY 565	Intelligent Systems in Business	3
INFSY 566	Data Mining and Knowledge Discovery	3
INFSY 547	WEB Enabled Technologies	3

Transfer Credits

Credits earned at other institutions but not used to earn a degree may be applied toward the requirements for a graduate degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>). It must be the opinion of the reviewing faculty that these courses are equivalent in quality to those offered at Penn State Harrisburg. Credit will not be given for any class used to complete a previous degree.

Course Substitutions

Because some students enter the Program with advanced knowledge in one or more subject areas, up to six credits in prescribed or additional courses may be replaced with more advanced undergraduate or graduate courses in the same subject area. Except for INFSY 554, which must be taken at the College, INFSY prescribed and additional courses, in cases where there is equivalent knowledge, must be replaced with more advanced courses in the same field. Substitutions are based on a minimum of six credits of advanced undergraduate course work in an area of concentration or credits earned in an equivalent graduate-level program at a regionally accredited, college-level institution. These courses must have been completed within the past five years and have earned a grade of B or better. Substituted courses must be replaced with other advanced graduate courses in the field for which the substitute is the foundation/prerequisite. Substitutions are based on past academic performance. An examination cannot be used for earned graduate course credit.

Integrated Undergrad-Grad Programs

Integrated B.S. in Information Systems and M.S. in Information Systems

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Information Systems with the M.S. in Information Systems offered at the following campuses:

Undergraduate Degree

- Harrisburg

Graduate Degree

- Harrisburg

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The School of Business Administration offers a limited number of academically superior Bachelor of Science in Information Systems students the opportunity to enroll in an integrated, continuous program of study leading to both the Bachelor of Science in Information Systems and the Master of Science in Information Systems. The ability to coordinate as well as concurrently pursue the two degree programs enables the students to earn both degrees in five years. Specifically, as many as twelve of the credits required for the master's degree may be applied to both undergraduate and graduate degree programs.

If for any reason students admitted to the IUG program are unable to complete the requirements for the Master of Science in Information Systems degree, the students will be permitted to receive the Bachelor of Science in Information Systems degree assuming all the undergraduate degree requirements have been satisfactorily completed.

ADMISSION REQUIREMENTS

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students apply to the program via the Graduate School application for admission (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet the admission requirements of the Graduate School, as well as the admission requirements for the Master of Science degree in Information Systems. Students should mention in the notes section that the application is for the IUG program in Information Systems.

Students must submit:

- a resume,
- a personal statement including career goals and how the M.S.I.S. will enhance their career goals,
- official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>) except for Penn State,

- two letters of recommendation, with at least one from the School of Business Administration faculty, and
- a plan of study that integrates both undergraduate and graduate requirements.

The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program. A Graduate Faculty adviser in collaboration with the Director of M.S.I.S. Program will help undergraduate candidates determine a sequence of courses that will prepare them for acceptance into the Integrated Undergraduate-Graduate (IUG) degree program.

The Graduate Management Admission Test (GMAT) or Graduate Record Examination (GRE) is not required for admission into the program; however, if students are interested in a graduate assistantship, GMAT or GRE scores must be submitted by the end of the eighth semester.

The number of openings in the IUG program is limited. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. In addition, the applicants must earn a minimum of cumulative grade point average of 3.5 and complete the following Entry to Major courses or equivalent:

Code	Title	Credits
ACCTG 211	Financial and Managerial Accounting for Decision Making	4
ECON 102	Introductory Microeconomic Analysis and Policy	3
ENGL 15	Rhetoric and Composition	3
or ENGL 30H	Honors Rhetoric and Composition	
FIN 301	Corporation Finance	3
MATH 110	Techniques of Calculus I	4
or MATH 140	Calculus With Analytic Geometry I	
MGMT 301	Basic Management Concepts	3
MKTG 301	Principles of Marketing	3
STAT 200	Elementary Statistics	4
or SCM 200	Introduction to Statistics for Business	

Student applications will be evaluated based on their overall portfolio, in addition to the above requirements. In all cases, admission to the program will be at the discretion of the Graduate Admissions Committee in Information Systems.

DEGREE REQUIREMENTS

Students must fulfill all degree requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Science in Information Systems are listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>). Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Up to 12 credits may be double-counted towards the degree requirements for both undergraduate and graduate degrees. All courses counted for both degrees must be at the 500- or 800-level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
INFSY 535	Object-Oriented Design and Programming in Business	3
INFSY 540	Information Technology and Knowledge Management	3
INFSY 555	Data Management Systems	3
INFSY 860	Data Communications Systems and Networks	3
INFSY 547	WEB Enabled Technologies	3
INFSY 543	Electronic Commerce	3
INFSY 570	Software Engineering in the Analysis and Design of Information Systems	3

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

There are a limited number of scholarships, fellowships, and research grants available, as well as several graduate assistantships. For more information on these, contact Penn State Harrisburg's School of Business Administration.

Many students work full-time and take classes part-time. In many cases, employers have a tuition-reimbursement plan paying for partial or full tuition. To find other options available to you, contact one of the following offices:

1. Financial Aid Office, 717-948-6307
2. Admissions, 717-948-6250

Graduate School Assistantships

Full time graduate students who are interested in an assistantship should contact the graduate program coordinator. Students must be nominated for an assistantship by their program coordinator. Students applying for an assistantship should submit scores from the Graduate Management Admissions Test (GMAT), Graduate Record Exam (GRE) or similar examinations by January 30.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Information Systems (INFSY) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/infsy/>)

Contact

Campus	Harrisburg
Graduate Program Head	John Haddad
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Parag C Pendharkar
Program Contact	Amy J Atkins Graduate Admissions 777 West Harrisburg Pike Middletown PA 17057 akj11@psu.edu (717) 948-6142
Program Website	View (https://harrisburg.psu.edu/business-administration/information-systems/master-science-information-systems/)

Integrative and Biomedical Physiology

Graduate Program Head	Gregory Shearer
Program Code	PHSIO
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Dual-title Ph.D. in Integrative and Biomedical Physiology and Clinical and Translational Sciences
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=PHSIO)

The Intercollege Graduate Degree Program (IGDP) in Integrative and Biomedical Physiology will enable students to obtain interdisciplinary training encompassing both the fundamentals of biomedical physiology and advanced training in a specialized area, in preparation for varied biomedical careers in academia or industry. This IGDP is uniquely

focused on the study of integrative mechanisms of mammalian body systems at the molecular, cellular, tissue, and organ levels, and the application of that knowledge to study a number of human diseases and conditions. A broad range of research is conducted by faculty, all of whom are widely regarded in their respective fields. Subspecialization areas include aging, exercise and muscle biology, biophysics, cancer, cardiovascular regulation and disease, energy and nutrient regulation, immunology and inflammation, obesity and diabetes, and reproductive biology. The master's program, including courses, laboratory experience, and original research, is designed for completion in approximately two years, while the doctoral degree requires approximately five years.

Graduate instruction in integrative and biomedical physiology is under the direction of graduate faculty from multiple colleges and departments at University Park—including animal science, biochemistry, biology, bioengineering, biomedical engineering, kinesiology, and nutrition, as well as veterinary and biomedical sciences.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students with a 3.00 junior/senior average (on a 4.00 scale) and with appropriate course backgrounds will be considered for admission. The best-qualified applicants will be accepted up to the number of spaces that are available for new students. Exceptions to the minimum 3.00 grade-point average may be made at the discretion of the program for students with special backgrounds, abilities, and interests. Deficiencies in chemistry, biological science, mathematics (through a second course in calculus), and physics must be made up early in the student's graduate program. The majority of students are admitted directly into the Ph.D. program. GRE scores are not required for admission.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

M.S. degree students must complete a minimum of 30 credits for the degree, including 21 core credits in:

Code	Title	Credits
Required Courses		
PHSIO 571	Integrative and Cellular Mammalian Physiology I	3
PHSIO 572	Integrative and Cellular Mammalian Physiology II Endocrine Physiology	3
NUTR 501	Regulation of Nutrient Metabolism I	4
MCIBS 591	Ethics, Rigor, Reproducibility and Conduct of Research in the Life Sciences	2
STAT 500	Applied Statistics	3
	3 credit course in immunology	3
	3-credit course in molecular biology	3
Total Credits		21

At least 6 credits in thesis research (PHSIO 600 or PHSIO 610) must be taken in conjunction with the thesis. The thesis must be accepted by the

advisers and/or committee members, the head of the graduate program, and the Graduate School, and the student must pass a thesis defense which includes a public presentation. Students in the non-thesis option must write a satisfactory scholarly paper, while enrolled in PHSIO 596.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

All candidates must complete rotations in physiology laboratories before choosing an area of specialization. Possible areas of specialization include cellular, molecular, animal or human aspects of the following:

- cardiovascular and respiratory physiology
- comparative physiology
- environmental physiology
- exercise physiology
- muscle physiology
- physiology of nutrition and metabolism
- immunology
- neurophysiology
- reproductive physiology

Students in the Ph.D. program must successfully pass the qualifying, comprehensive, and final oral examination (the dissertation defense) required by Graduate Council. To earn the Ph.D. degree, doctoral students must also write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School. The Ph.D. committee shall be appropriately represented by members of the Integrative and Biomedical Physiology faculty and those of the area of specialization who shall have the responsibility and jurisdiction for determining the course program and research acceptable in satisfying degree requirements.

The doctoral degree in Integrative and Biomedical Physiology requires a minimum of 30 credits, including:

Code	Title	Credits
Required Courses		
PHSIO 571	Integrative and Cellular Mammalian Physiology I	3
PHSIO 572	Integrative and Cellular Mammalian Physiology II Endocrine Physiology	3
NUTR 501	Regulation of Nutrient Metabolism I	4
MCIBS 591	Ethics, Rigor, Reproducibility and Conduct of Research in the Life Sciences	2
PHSIO 590	Colloquium	2
STAT 501	Regression Methods	3
STAT 502	Analysis of Variance and Design of Experiments	3
	3-credit course in immunology	3
	3-credit course in molecular biology	3
	Other Seminars	4
Electives		
	The remaining 5 credits may be chosen from 500-level Physiology courses or other relevant 400- or 500-level course. For a list of suggested courses, contact the graduate program.	5
Total Credits		35

Students must earn a grade of B or better in each course and maintain an overall average of 3.00.

Dual-Titles

Dual-title Ph.D. in Integrative and Biomedical Physiology and Clinical and Translational Sciences

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

IBMP doctoral students interested in having a degree that reflects advanced training in the design, analysis, interpretation, implementation, and dissemination of physiological research aimed at improving human health may apply to pursue a dual-title Ph.D. in IBMP and Clinical and Translational Sciences. The CTS program encourages interdisciplinary scholarly work at the interface between basic sciences, clinical sciences and human health. This program is applicable for students pursuing academic careers in the area of basic research focused on processes that can be targeted through intervention practice; the development or improvement of therapeutics, devices, and/or intervention programs; clinical trials in the academic, public, or private sector; and/or the science of translation and dissemination. The program is well-suited for students pursuing non-academic careers related to drug discovery and implementation of new diagnostics, treatments or devices. The CTS dual-title complements the expertise that students in IBMP acquire in basic mechanisms underlying disease.

Admission Requirements

Students must apply and be admitted to the graduate program in IBMP and the Graduate School before they can be admitted to a dual-title degree program. Applicants interested in the dual-title degree program may note their interest in their applications to IBMP. After admission to IBMP, students must apply for admission to and meet the admissions requirements of the CTS dual-title program. Refer to the Admission Requirements section of the CTS Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/clinical-translational-sciences/>). Students admitted to the IBMP program will be admitted to the dual-title program in Clinical and Translational Sciences upon the recommendation of a faculty member affiliated with the dual-title. Students must be admitted apply to CTS prior to taking their qualifying exam.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the requirements of the Ph.D. in IBMP, listed on the Degree Requirements tab. In addition, students pursuing the dual-title Ph.D. in IBMP and Clinical and Translational Sciences must complete the degree requirements for the dual-title Clinical and Translational Sciences Ph.D., listed on the Clinical and Translational Sciences Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/clinical-translational-sciences/>).

Students' Qualifying Examination committee for the dual-title degree must fulfill composition requirements for IBMP, and at least one of the committee members must hold Graduate Faculty status in Clinical and Translational Sciences. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both IBMP and Clinical & Translational Sciences. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

Similarly, the Ph.D. Committee (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>) of a dual-title doctoral degree student must either be chaired by a faculty member holding appointments in both IBMP and Clinical Translational Sciences, or be co-chaired by two faculty members who each represent one discipline. The Ph.D. Committee will oversee the Comprehensive Exam, which must meet the requirements established in the IBMP Program, as well as demonstrate expertise in an area deemed relevant to Clinical Translational Sciences by the Committee chair or co-chair.

Ph.D. candidates must complete a dissertation on a topic that reflects their original research on a topic approved by IBMP and the CTS program; specifically, one that translates biomedical discovery into applications with the goal of improving human health. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

Requirements listed here are in addition to requirements for minors in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The objective of the doctoral minor in Integrative and Biomedical Physiology is to augment the training of doctoral students with a coordinated group of courses that provide an integrated perspective of physiology from the molecular to the organismal level. It is expected that most students pursuing the minor will be graduate degree candidates in basic biological sciences, health sciences, or bioengineering.

The doctoral minor in Integrative and Biomedical Physiology requires the following:

- BIOL 472 (<https://bulletins.psu.edu/search/?P=BIOL%20472>) - If the student took a one-semester, upper-level undergraduate mammalian physiology course as an undergraduate, then this requirement may be waived with approval by the chair of the Integrative and Biomedical Physiology program.
- PHSIO 571 (<https://bulletins.psu.edu/search/?P=PHSIO%20571>) and PHSIO 572 (<https://bulletins.psu.edu/search/?P=PHSIO%20572>) - If these courses are required for the major, then substitute an equal number of credits in 500-level Integrative and Biomedical Physiology elective courses.
- A 3-credit, 500-level Integrative and Biomedical Physiology elective course.
- Select additional credits from 500-level Integrative and Biomedical Physiology courses or a relevant 400- or 500-level course so that the total course credits for the minor is 15. These 15 credits cannot include course work that is used to fulfill requirements in the student's major.
- Elective courses for the minor must be approved by the chair of the Integrative and Biomedical Physiology program. For a list of suggested courses, contact the graduate program.
- Students must earn a grade of C or better in each course in the minor and maintain an overall average of 3.00 in the minor.
- One member of the Ph.D. committee must be a faculty member in the Intercollege Graduate Degree Program in Integrative and Biomedical Physiology.

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Physiology (PHSIO) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/phsio/>)

Contact

Campus

University Park

Graduate Program Head

Gregory C Shearer

Program Contact

Freya Heryla

101 Life Sciences Building

University Park PA 16802

fqh5144@psu.edu

(814) 863-3273

Program Website

View (<https://www.huck.psu.edu/graduate-programs/integrative-and-biomedical-physiology/>)

International Affairs

Graduate Program Head	Mitchell Smith
Program Code	INTAF
Campus(es)	University Park (M.I.A.)
Degrees Conferred	<p>Master of International Affairs (M.I.A.)</p> <p>Integrated B.S. in Aerospace Engineering and M.I.A. in International Affairs</p> <p>Integrated B.A. in Asian Studies and M.I.A. in International Affairs</p> <p>Integrated B.A. in Chinese and M.I.A. in International Affairs</p> <p>Integrated B.S. in Computer Engineering and M.I.A. in International Affairs</p> <p>Integrated B.S. in Computer Science and M.I.A. in International Affairs</p> <p>Integrated B.A. in Criminology and M.I.A. in International Affairs</p> <p>Integrated B.S. in Criminology and M.I.A. in International Affairs</p> <p>Integrated B.S. in Electrical Engineering and M.I.A. in International Affairs</p> <p>Integrated B.A. in German and M.I.A. in International Affairs</p> <p>Integrated B.S. in German and M.I.A. in International Affairs</p> <p>Integrated B.A. in Global and International Studies and M.I.A. in International Affairs</p> <p>Integrated B.S. in Global and International Studies and M.I.A. in International Affairs</p> <p>Integrated B.S. in Health Policy and Administration and M.I.A. in International Affairs</p> <p>Integrated B.A. in International Politics and M.I.A. in International Affairs</p> <p>Integrated B.A. in Japanese and M.I.A. in International Affairs</p> <p>Integrated B.A. in Political Science and M.I.A. in International Affairs</p> <p>Integrated B.A. in Russian and M.I.A. in International Affairs</p> <p>Integrated B.S. in Security and Risk Analysis and M.I.A. in International Affairs</p> <p>Integrated B.A. in Sociology and M.I.A. in International Affairs</p> <p>Integrated B.S. in Sociology and M.I.A. in International Affairs</p> <p>Joint J.D./M.I.A. with Penn State Law</p>
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=INTAF)

The School of International Affairs (SIA) is designed to prepare students for occupations involving public service, private enterprise, nonprofit organizations, and international organizations worldwide. The Master of International Affairs (M.I.A.) degree program will provide students with a substantial knowledge base in international systems, institutions, issues and history and the advanced analytical tools and cross-cultural skills and competencies necessary for these occupations. Students will work closely with faculty to design a curriculum around their core course work, which incorporates a functional or regional theme and provides the opportunity to apply and enhance the core knowledge component with a thematically based set of graduate courses from across Penn State's existing graduate and professional curriculum.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

All applicants will submit two letters of recommendation, a current resume or CV, and a statement of purpose. Applicants must submit official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>).

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Applicants with a minimum TOEFL total score of 80 with a score of 19 or higher on the speaking section of the TOEFL Internet-based test will be considered for admission, though a score of 23 or higher is desirable.

Admissions will be based on a review of all submitted materials and spaces will be offered to the best qualified applicants, taking into account academic achievement, relevant work experience and other indices of aptitude for advanced study in international affairs.

Degree Requirements

Master of International Affairs (M.I.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The program requires six courses which are designed to establish a base of knowledge in key subject areas which reflect the basic mission of the SIA. These courses will form the core curriculum for the M.I.A. This core curriculum is designed to provide students with a strong foundation in the ethical dimensions of international exchange, with skills essential to perform quantitative and qualitative analysis in cross-cultural contexts and with leadership training designed to understand and bridge the cultural differences. A minimum of 42 credits at the 400, 500 or 800 level will be required for completion of the program, at least 18 of which must be from courses at the 500 and 800 level. A minimum of 6 credits must be at the 500 level. Students are required to take 18 credits of core courses in: INTAF 506(3), INTAF 801(3), INTAF 802(3), INTAF 803(3), INTAF 804(3), and INTAF 890(3).

Code	Title	Credits
Required Courses		
INTAF 506	International Economics: Principles, Policies, and Practices	3
INTAF 801	Actors, Institutions, and Legal Frameworks in International Affairs	3
INTAF 802	Foundations of Diplomacy and International Relations Theory	3
INTAF 803	Multi-sector and Quantitative Analysis	3
INTAF 804	Global Cultures and Leadership	3
INTAF 890	Colloquium	3
Electives		
	Students will choose their remaining courses, with faculty guidance, from a substantial list of elective courses for a total of 21 credits. A list of approved elective courses is maintained by the graduate program office. The courses usually will be clustered around areas of concentration designated by the SIA faculty, but students also will be permitted to design an independent interdisciplinary curriculum with faculty approval. The areas of concentration, which will be pre-approved by the faculty, will take advantage of Penn State's rich graduate curriculum by aggregating in appropriate thematic clusters pre-existing and specially-created graduate-level classes.	21
Culminating Experience		
INTAF 594	Research Topics (Master's Paper)	3
or INTAF 595	Internship	
Total Credits		42

In addition to the core curriculum and elective courses, degree candidates must complete either:

- i. a master's paper; or
- ii. a supervised internship placement.

If the first option is chosen and the candidate opts to complete a paper, they must enroll in 3 credits of INTAF 594. The master's paper will involve integrating and showing mastery of the subject matter of the student's curricular emphasis, and may also involve original research. If the second option is chosen, the candidate will enroll in 3 credits of INTAF 595. The student will participate in a supervised internship placement of sufficient depth and professionalism that will allow the student to experience the integration of their curricular studies in an actual professional environment. A reflective paper will be submitted as a part of this credit requirement.

In order to graduate, students also will need to demonstrate proficiency in a language other than English. Proficiency will be defined as follows:

1. four semesters of a Penn State language sequence or its equivalent (15 credits with a quality grade of a C or better using a 4.0 scale);
2. native acquisition, as shown by the candidate's personal history and approved by the SIA faculty; or
3. performance on a proficiency evaluation sufficient to equal four semesters of language learning: for this purpose, either Penn State's proficiency certification process or another pre-approved proficiency assessment may be used.

Integrated Undergrad-Grad Programs

Integrated B.S. in Aerospace Engineering and M.I.A. in International Affairs

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Aerospace Engineering with the M.I.A. in International Affairs offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- University Park

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The integrated undergraduate-graduate (IUG) degree program (B.S. in Aerospace Engineering/M.I.A. in International Affairs) provides an opportunity for strong students in these majors to complete a master's degree with 5 total years of study.

Aerospace is truly a global enterprise, with civil aviation enabling international commerce and passenger transport, military aerospace at the fore-front of foreign policy, and the capability to place telecommunications and other vital infrastructures in space in a manner transcending national boundaries. This program will allow students to obtain an interdisciplinary education by pursuing both the aerospace engineering and the international affairs programs.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The number of openings in the integrated B.S./M.I.A. program is limited. Admission will be selective based on specific criteria set by the School of International Affairs. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. Specific requirements:

1. Must be enrolled in the Bachelor of Science in Aerospace Engineering program.
2. Must apply to and be accepted into The Graduate School and the M.I.A. program in the School of International Affairs. Students must complete the Graduate School application (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>). All applicants will submit one letter of recommendation and a personal statement addressing their reasons for pursuing a graduate degree in international affairs and discussing their plans and goals.

- Applicants are generally expected to have a minimum overall GPA of 3.5 (on a 4.0 scale) in undergraduate course work and a minimum GPA of 3.5 in all coursework completed for the major.
- Must include a plan of study identifying undergraduate credits to be applied to the M.I.A. degree elective requirements. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.S. in Aerospace Engineering are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.I.A. degree are listed on the Degree Requirements tab.

If students accepted into the IUG program are unable to complete the M.I.A. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted credits must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
AERSP 401A	Spacecraft Design–Preliminary	3
AERSP 402A	Aircraft Design–Preliminary	3
AERSP 413	Stability and Control of Aircraft	3
AERSP 424	Advanced Computer Programming	3
AERSP 440	Introduction to Software Engineering for Aerospace Engineers	3
AERSP 450	Orbit and Attitude Control of Spacecraft	3
INTAF 500	Research Design	3
INTAF 506	International Economics: Principles, Policies, and Practices	3
INTAF 803	Multi-sector and Quantitative Analysis	3

Integrated B.A. in Asian Studies and M.I.A. in International Affairs

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.A. in Asian Studies with the M.I.A. in International Affairs offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- University Park

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The integrated undergraduate-graduate (IUG) degree program (B.A. in Asian Studies / M.I.A. in International Affairs) provides an opportunity for strong students in this major to complete a master's degree with 5 total years of study.

An increasingly globalized economy is likely to escalate the demand for graduate training in international affairs. The career choices for graduates with this training will also expand sharply.

The integrated degree program prepares students for a variety of careers requiring an interdisciplinary background in Asian Studies or Asian languages and international affairs. Examples of types of entities hiring in these areas are federal, state, and local governments, international organizations, multinational corporations, international banking and financial institutions, media organizations and journalism, consulting firms, policy research centers, and development assistance programs and foundations. The School of International Affairs (SIA) Master of International Affairs (M.I.A.) represents a professional degree designed to prepare students to thrive in these increasingly global career paths.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The number of openings in the integrated B.A./M.I.A. program is limited. Admission will be selective based on specific criteria set by the School of International Affairs. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. Specific requirements:

- Must be enrolled in the Asian Studies B.A. program.
- Must apply to and be accepted into The Graduate School and the M.I.A. program in the School of International Affairs. Students must complete the Graduate School application (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>). All applicants will submit one letter of recommendation and a personal statement addressing their reasons for pursuing a graduate degree in international affairs and discussing their plans and goals.
- Although the program has no fixed minimum grade point average, an applicant is generally expected to have a minimum overall GPA of 3.5 (on a 4.0 scale) in undergraduate course work and a minimum GPA of 3.5 in all course work completed for the major.
- Must include a plan of study identifying undergraduate credits to be applied to the M.I.A. degree elective requirements. The plan should

cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser.

5. Must provide written endorsement from the head of Asian Studies.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Arts in Asian Studies are listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.I.A. degree are listed on the Degree Requirements tab. If students accepted into the IUG program are unable to complete the M.I.A. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted credits must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
ASIA 400	International Culture in East Asia	3
ASIA 401	Technology & Society in Modern Asia	3
ASIA 430	Japan in the World	3
ASIA 463		
ASIA 465Y	Democratization in Asia	3
ASIA 469	Government and Politics of South Asia	3
ASIA 475Y	The Making and Emergence of Modern India	3
ASIA 481	Modern Japan Since 1800	3
ASIA 486	China in Revolution	3
ASIA 501	Proseminar in Asian Studies I	1-3
ASIA 502	Proseminar in Asian Studies II	1-3
ASIA 577	Critical Perspectives on Modern Chinese Literature	3

Integrated B.A. in Chinese and M.I.A. in International Affairs

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.A. in Chinese with the M.I.A. in International Affairs offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- University Park

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs

(<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The integrated undergraduate-graduate (IUG) degree program (B.A. in Chinese/M.I.A. in International Affairs) provides an opportunity for strong students in this major to complete a master's degree with 5 total years of study.

An increasingly globalized economy is likely to escalate the demand for graduate training in international affairs. The career choices for graduates with this training will also expand sharply.

The integrated degree program prepares students for a variety of careers requiring an interdisciplinary background in Asian languages and international affairs. Examples of types of entities hiring in these areas are federal, state, and local governments, international organizations, multinational corporations, international banking and financial institutions, media organizations and journalism, consulting firms, policy research centers, and development assistance programs and foundations. The School of International Affairs (SIA) Master of International Affairs (M.I.A.) represents a professional degree designed to prepare students to thrive in these increasingly global career paths.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The number of openings in the integrated B.A./M.I.A. program is limited. Admission will be selective based on specific criteria set by the School of International Affairs. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. Specific requirements:

1. Must be enrolled in the Chinese B.A. program.
2. Must apply to and be accepted into The Graduate School and the M.I.A. program in the School of International Affairs. Students must complete the Graduate School application (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>). All applicants will submit one letter of recommendation and a personal statement addressing their reasons for pursuing a graduate degree in international affairs and discussing their plans and goals.
3. Although the program has no fixed minimum grade point average, an applicant is generally expected to have a minimum overall GPA of 3.5 (on a 4.0 scale) in undergraduate course work and a minimum GPA of 3.5 in all course work completed for the major.
4. Must include a plan of study identifying undergraduate credits to be applied to the M.I.A. degree elective requirements. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser.
5. Must provide written endorsement from the head of Asian Studies.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Arts in Asian Studies,

Chinese, and Japanese are listed on the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.I.A. degree are listed on the Degree Requirements tab. If students accepted into the IUG program are unable to complete the M.I.A. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted credits must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
ASIA 400	International Culture in East Asia	3
ASIA 401	Technology & Society in Modern Asia	3
ASIA 430	Japan in the World	3
ASIA 463		
ASIA 465Y	Democratization in Asia	3
ASIA 469	Government and Politics of South Asia	3
ASIA 475Y	The Making and Emergence of Modern India	3
ASIA 481	Modern Japan Since 1800	3
ASIA 486	China in Revolution	3
ASIA 501	Proseminar in Asian Studies I	1-3
ASIA 502	Proseminar in Asian Studies II	1-3
ASIA 577	Critical Perspectives on Modern Chinese Literature	3

INTEGRATED B.S. IN COMPUTER ENGINEERING AND M.I.A. IN INTERNATIONAL AFFAIRS

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Computer Engineering with the M.I.A. in International Affairs offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- University Park

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The integrated undergraduate-graduate (IUG) degree program (B.S. in Computer Engineering/M.I.A. in International Affairs) provides an opportunity for strong students in these majors to complete a master's degree with 5 total years of study.

In the field of computer engineering, there are a number of different industries and careers in which students may choose to enter, some of which may be in the international context or have international elements. Given the interdisciplinary nature of this evolving field, an interdisciplinary program can help to prepare students for their future careers and prepare the next generation of computer engineers to work in an increasingly globalized context.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The number of openings in the integrated B.S./M.I.A. program is limited. Admission will be selective based on specific criteria set by the School of International Affairs. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. Specific requirements:

1. Must be enrolled in the Bachelor of Science in Computer Engineering program.
2. Must apply to and be accepted into The Graduate School and the M.I.A. program in the School of International Affairs. Students must complete the Graduate School application. All applicants will submit one letter of recommendation, a resume, and a personal statement addressing their reasons for pursuing a graduate degree in international affairs and discussing their plans and goals.
3. Applicants are generally expected to have a minimum overall GPA of 3.5 (on a 4.0 scale) in undergraduate coursework.
4. Must include a plan of study identifying undergraduate credits to be applied to the M.I.A. degree elective requirements. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser.

DEGREE REQUIREMENTS

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.S. in Computer Engineering are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.I.A. degree are listed on the Degree Requirements tab. If students accepted into the IUG program are unable to complete the M.I.A. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted credits must be at the 500 or 800 level. Independent

study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
CMPEN 431	Introduction to Computer Architecture	3
CMPEN 482W	Computer Engineering Project Design	3
CMPSC 465	Data Structures and Algorithms	3
CMPSC 473	Operating Systems Design & Construction	3
STAT 418	Introduction to Probability and Stochastic Processes for Engineering	3
INTAF 506	International Economics: Principles, Policies, and Practices	3
INTAF 803	Multi-sector and Quantitative Analysis	3

Integrated B.S. in Computer Science and M.I.A. in International Affairs

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Computer Science with the M.I.A. in International Affairs offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- University Park

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The integrated undergraduate-graduate (IUG) degree program (B.S. in Computer Science/M.I.A. in International Affairs) provides an opportunity for strong students in these majors to complete a master's degree with 5 total years of study.

In the field of computer science, there are a number of different industries and careers in which students may choose to enter, some of which may be in the international context or have international elements. Given the interdisciplinary nature of this evolving field, an interdisciplinary program can help to prepare students for their future careers and prepare the next generation of computer scientists to work in an increasingly globalized context.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The number of openings in the integrated B.S./M.I.A. program is limited. Admission will be selective based on specific criteria set by the School of International Affairs. Students must apply to and meet admission requirements of the Graduate School, as well as the graduate program in which they intend to receive their master's degree. Before applying to the Graduate School, students must have completed entrance to

their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. Specific requirements:

1. Must be enrolled in the Bachelor of Science in Computer Science program.
2. Must apply to and be accepted into The Graduate School and the M.I.A. program in the School of International Affairs. Students must complete the Graduate School application. All applicants will submit one letter of recommendation, a resume, and a personal statement addressing their reasons for pursuing a graduate degree in international affairs and discussing their plans and goals.
3. Applicants are generally expected to have a minimum overall GPA of 3.5 (on a 4.0 scale) in undergraduate coursework.
4. Must include a plan of study identifying undergraduate credits to be applied to the M.I.A. degree elective requirements. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser.

DEGREE REQUIREMENTS

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.S. in Computer Science are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.I.A. degree are listed on the Degree Requirements tab. If students accepted into the IUG program are unable to complete the M.I.A. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted credits must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
CMPSC 431W	Database Management Systems	3
CMPSC 461	Programming Language Concepts	3
CMPSC 464	Introduction to the Theory of Computation	3
CMPSC 465	Data Structures and Algorithms	3
CMPSC 473	Operating Systems Design & Construction	3
CMPSC 483W	Software Design Methods	3
INTAF 506	International Economics: Principles, Policies, and Practices	3
INTAF 803	Multi-sector and Quantitative Analysis	3

INTEGRATED B.A. IN CRIMINOLOGY AND M.I.A. IN INTERNATIONAL AFFAIRS

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.A. in Criminology with the M.I.A. in International Affairs offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- University Park

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The integrated undergraduate-graduate (IUG) degree program (B.A. in Criminology/M.I.A. in International Affairs) provides an opportunity for strong students in these majors to complete a master's degree with 5 total years of study.

In an increasingly globalized world, this interdisciplinary program can help provide students with a foundation in a variety of criminal justice topics while viewing them in the international context. Examples of the types of entities that graduates of this program may pursue careers at include federal, state, and local governments, non-governmental organizations, international organizations, intergovernmental organizations, multinational corporations, consulting firms, and policy research centers. As future global leaders attempting to remedy and resolve some of the world's most challenging issues, this program can help to prepare students for their careers.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The number of openings in the integrated B.A./M.I.A. program is limited. Admission will be selective based on specific criteria set by the School of International Affairs. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. Specific requirements:

1. Must be enrolled in the Bachelor of Arts in Criminology program.
2. Must apply to and be accepted into The Graduate School and the M.I.A. program in the School of International Affairs. Students must complete the Graduate School application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>). All applicants will submit one letter of recommendation and a personal statement addressing their reasons for pursuing a graduate degree in international affairs and discussing their plans and goals.

3. Applicants are generally expected to have a minimum overall GPA of 3.5 (on a 4.0 scale) in undergraduate coursework and a minimum GPA of 3.5 in all coursework completed for the major.
4. Must include a plan of study identifying undergraduate credits to be applied to the M.I.A. degree elective requirements. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser.

DEGREE REQUIREMENTS

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.A. in Criminology are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.I.A. degree are listed on the Degree Requirements tab. If students accepted into the IUG program are unable to complete the M.I.A. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted credits must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
CRIM 413	Advanced Criminological Theory	3
CRIM 421	Violent Crime in the United States	3
CRIM 423	Sexual and Domestic Violence	3
CRIM 424	Drugs, Crime, and Society	3
CRIM 430	American Correctional System	3
CRIM 432	Crime and the American Court System	3
CRIM 433	Sentencing	3
CRIM 435	Policing in America	3
CRIM 441	The Juvenile Justice System	3
CRIM 451	Race, Crime, and Justice	3
CRIM 453	Women and the Criminal Justice System	3
CRIM/SOC 467	Law and Society	3
CRIM 490	Crime Policy	3
INTAF 506	International Economics: Principles, Policies, and Practices	3
INTAF 801	Actors, Institutions, and Legal Frameworks in International Affairs	3
INTAF 802	Foundations of Diplomacy and International Relations Theory	3
INTAF 803	Multi-sector and Quantitative Analysis	3
INTAF 890	Colloquium	3

INTEGRATED B.S. IN CRIMINOLOGY AND M.I.A. IN INTERNATIONAL AFFAIRS

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Criminology with the M.I.A. in International Affairs offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- University Park

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The integrated undergraduate-graduate (IUG) degree program (B.S. in Criminology/M.I.A. in International Affairs) provides an opportunity for strong students in these majors to complete a master's degree with 5 total years of study.

In an increasingly globalized world, this interdisciplinary program can help provide students with a foundation in a variety of criminal justice topics while viewing them in the international context. Examples of the types of entities that graduates of this program may pursue careers at include federal, state, and local governments, non-governmental organizations, international organizations, intergovernmental organizations, multinational corporations, consulting firms, and policy research centers. As future global leaders attempting to remedy and resolve some of the world's most challenging issues, this program can help to prepare students for their careers.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The number of openings in the integrated B.S./M.I.A. program is limited. Admission will be selective based on specific criteria set by the School of International Affairs. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. Specific requirements:

1. Must be enrolled in the Bachelor of Science in Criminology program.
2. Must apply to and be accepted into The Graduate School and the M.I.A. program in the School of International Affairs. Students must complete the Graduate School application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>). All applicants will submit one letter of recommendation and a personal statement addressing their reasons for pursuing a graduate degree in international affairs and discussing their plans and goals.

3. Applicants are generally expected to have a minimum overall GPA of 3.5 (on a 4.0 scale) in undergraduate coursework and a minimum GPA of 3.5 in all coursework completed for the major.
4. Must include a plan of study identifying undergraduate credits to be applied to the M.I.A. degree elective requirements. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser.

DEGREE REQUIREMENTS

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.S. in Criminology are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.I.A. degree are listed on the Degree Requirements tab. If students accepted into the IUG program are unable to complete the M.I.A. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted credits must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
CRIM 413	Advanced Criminological Theory	3
CRIM 421	Violent Crime in the United States	3
CRIM 423	Sexual and Domestic Violence	3
CRIM 424	Drugs, Crime, and Society	3
CRIM 430	American Correctional System	3
CRIM 432	Crime and the American Court System	3
CRIM 433	Sentencing	3
CRIM 435	Policing in America	3
CRIM 441	The Juvenile Justice System	3
CRIM 451	Race, Crime, and Justice	3
CRIM 453	Women and the Criminal Justice System	3
CRIM/SOC 467	Law and Society	3
CRIM 490	Crime Policy	3
INTAF 506	International Economics: Principles, Policies, and Practices	3
INTAF 801	Actors, Institutions, and Legal Frameworks in International Affairs	3
INTAF 802	Foundations of Diplomacy and International Relations Theory	3
INTAF 803	Multi-sector and Quantitative Analysis	3
INTAF 890	Colloquium	3

INTEGRATED B.S. IN ELECTRICAL ENGINEERING AND M.I.A. IN INTERNATIONAL AFFAIRS

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Electrical Engineering with the M.I.A. in International Affairs offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- University Park

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The integrated undergraduate-graduate (IUG) degree program (B.S. in Electrical Engineering /M.I.A. in International Affairs) provides an opportunity for strong students in these majors to complete a master's degree with 5 total years of study.

In the field of electrical engineering, there are a number of different industries and careers in which students may choose to enter, some of which may be in the international context or have international elements. Given the interdisciplinary nature of this evolving field, an interdisciplinary program can help to prepare students for their future careers and prepare the next generation of electrical engineers to work in an increasingly globalized context.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The number of openings in the integrated B.S./M.I.A. program is limited. Admission will be selective based on specific criteria set by the School of International Affairs. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. Specific requirements:

1. Must be enrolled in the Bachelor of Science in Electrical Engineering program.
2. Must apply to and be accepted into The Graduate School and the M.I.A. program in the School of International Affairs. Students must complete the Graduate School application. All applicants will submit one letter of recommendation, a resume, and a personal statement addressing their reasons for pursuing a graduate degree in international affairs and discussing their plans and goals.
3. Applicants are generally expected to have a minimum overall GPA of 3.5 (on a 4.0 scale) in undergraduate coursework.
4. Must include a plan of study identifying undergraduate credits to be applied to the M.I.A. degree elective requirements. The plan should

cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser.

DEGREE REQUIREMENTS

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.S. in Electrical Engineering are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.I.A. degree are listed on the Degree Requirements tab. If students accepted into the IUG program are unable to complete the M.I.A. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted credits must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
EE 410	Linear Electronic Design	3
EE 413	Power Electronics	3
EE 416	Digital Integrated Circuits	3
EE 417	Digital Design Using Field Programmable Devices	3
EE 420	Electro-optics: Principles and Devices	3
EE 421	Optical Fiber Communications	3
EE 422	Optical Engineering Laboratory	3
EE 424	Principles and Applications of Lasers	3
EE 430	Principles of Electromagnetic Fields	3
EE 432	RF and Microwave Engineering	3
EE 438	Antenna Engineering	3
EE 441	Semiconductor Integrated Circuit Technology	3
EE 442	Solid State Devices	3
EE 453	Fundamentals of Digital Signal Processing	3
EE 454	Fundamentals of Computer Vision	3
EE 455	An Introduction to Digital Image Processing	3
EE 460	Communication Systems II	3
EE 471	Introduction to Plasmas	3
EE 472	Space Astronomy and Introduction to Space Science	3
EE 474	Satellite Communications Systems	3
EE 477	Fundamentals of Remote Sensing Systems	3
EE 482	Introduction to Digital Control Systems	3
EE 487	Electric Machinery and Drives	3
EE 488	Power Systems Analysis I	3
INTAF 506	International Economics: Principles, Policies, and Practices	3
INTAF 803	Multi-sector and Quantitative Analysis	3

Integrated B.A. in German and M.I.A. in International Affairs

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.A. in German with the M.I.A. in International Affairs offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- University Park

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The integrated undergraduate-graduate (IUG) degree program (B.A. in German/M.I.A. in International Affairs) provides an opportunity for strong students in this major to complete a master's degree with 5 total years of study.

An increasingly globalized economy is likely to escalate the demand for graduate training in international affairs. The career choices for graduates with this training will also expand sharply. The integrated degree program prepares students for a variety of careers requiring an interdisciplinary background in German and international affairs. Examples of types of entities hiring in these areas are federal, state, and local governments, international organizations, multinational corporations, international banking and financial institutions, media organizations and journalism, consulting firms, policy research centers, and development assistance programs and foundations. The School of International Affairs (SIA) Master of International Affairs (M.I.A.) represents a professional degree designed to prepare students to thrive in these increasingly global career paths.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The number of openings in the integrated B.A./M.I.A. program is limited. Admission will be selective based on specific criteria set by the School of International Affairs. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. Specific requirements:

1. Must be enrolled in the German B.A. program.
2. Must apply to and be accepted into The Graduate School and the M.I.A. program in the School of International Affairs. Students must complete the Graduate School application (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>). All applicants will submit one letter of recommendation and a personal

statement addressing their reasons for pursuing a graduate degree in international affairs and discussing their plans and goals.

3. Although the program has no fixed minimum grade point average, an applicant is generally expected to have a minimum overall GPA of 3.5 (on a 4.0 scale) in undergraduate course work and a minimum GPA of 3.5 in all course work completed for the major.
4. Must include a plan of study identifying undergraduate credits to be applied to the M.I.A. degree elective requirements. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser.
5. Must provide written endorsement from the head of Germanic and Slavic Languages and Literatures.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Arts in German are listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.I.A. degree are listed on the Degree Requirements tab. If students accepted into the IUG program are unable to complete the M.I.A. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted credit must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
GER 408	Advanced German Business Communications	3
GER 431	History of German Literature and Culture I	3
GER 432	History of German Literature and Culture II	3
GER 489	Introduction to German Film History and Theory in Context	3
GER 494	Research Project	1-12
GER 540	Seminar in German Culture and Civilization	3-12
GER 581	Topics in Literary Genres	3-12
GER 592	Seminar in German Literature	3

Integrated B.S. in German and M.I.A. in International Affairs

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in German with the M.I.A. in International Affairs offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- University Park

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The integrated undergraduate-graduate (IUG) degree program (B.S. in German/M.I.A. in International Affairs) provides an opportunity for strong students in this major to complete a master's degree with 5 total years of study.

An increasingly globalized economy is likely to escalate the demand for graduate training in international affairs. The career choices for graduates with this training will also expand sharply. The integrated degree program prepares students for a variety of careers requiring an interdisciplinary background in German and international affairs. Examples of types of entities hiring in these areas are federal, state, and local governments, international organizations, multinational corporations, international banking and financial institutions, media organizations and journalism, consulting firms, policy research centers, and development assistance programs and foundations. The School of International Affairs (SIA) Master of International Affairs (M.I.A.) represents a professional degree designed to prepare students to thrive in these increasingly global career paths.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The number of openings in the integrated B.S./M.I.A. program is limited. Admission will be selective based on specific criteria set by the School of International Affairs. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. Specific requirements:

1. Must be enrolled in the German B.S. program.
2. Must apply to and be accepted into The Graduate School and the M.I.A. program in the School of International Affairs. Students must complete the Graduate School application (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>). All applicants will submit one letter of recommendation and a personal statement addressing their reasons for pursuing a graduate degree in international affairs and discussing their plans and goals.
3. Although the program has no fixed minimum grade point average, an applicant is generally expected to have a minimum overall GPA of 3.5 (on a 4.0 scale) in undergraduate course work and a minimum GPA of 3.5 in all course work completed for the major.
4. Must include a plan of study identifying undergraduate credits to be applied to the M.I.A. degree elective requirements. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser.

5. Must provide written endorsement from the head of Germanic and Slavic Languages and Literatures.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Science in German are listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.I.A. degree are listed on the Degree Requirements tab. If students accepted into the IUG program are unable to complete the M.I.A. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
GER 408	Advanced German Business Communications	3
GER 431	History of German Literature and Culture I	3
GER 432	History of German Literature and Culture II	3
GER 489	Introduction to German Film History and Theory in Context	3
GER 494	Research Project	1-12
GER 540	Seminar in German Culture and Civilization	3-12
GER 581	Topics in Literary Genres	3-12
GER 592	Seminar in German Literature	3

INTEGRATED B.A. IN GLOBAL AND INTERNATIONAL STUDIES AND M.I.A. IN INTERNATIONAL AFFAIRS

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.A. in Global and International Studies with the M.I.A. in International Affairs offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- University Park

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The integrated undergraduate-graduate (IUG) degree program (B.A. in Global and International Studies/M.I.A. in International Affairs) provides

an opportunity for strong students in these majors to complete a master's degree with 5 total years of study.

An increasingly globalized economy is likely to escalate the demand for graduate training in international affairs and career choices for graduates with this training will also expand sharply. The integrated degree program would prepare students for a variety of careers requiring an interdisciplinary background in global and international studies and international affairs. Examples of types of entities hiring in these areas are federal, state, and local governments, international organizations, multinational corporations, international banking and financial institutions, media organizations and journalism, consulting firms, policy research centers, and development assistance programs and foundations. The School of International Affairs (SIA) M.I.A. represents a professional degree designed to prepare students to thrive in these increasingly global career paths.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The number of openings in the integrated B.A./M.I.A. program is limited. Admission will be selective based on specific criteria set by the School of International Affairs. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. Specific requirements:

1. Must be enrolled in the Bachelor of Arts in Global and International Studies program.
2. Must apply to and be accepted into The Graduate School and the M.I.A. program in the School of International Affairs. Students must complete the Graduate School application. All applicants will submit one letter of recommendation and a personal statement addressing their reasons for pursuing a graduate degree in international affairs and discussing their plans and goals.
3. Applicants are generally expected to have a minimum overall GPA of 3.5 (on a 4.0 scale) in undergraduate coursework and a minimum GPA of 3.5 in all coursework completed for the major.
4. Must include a plan of study identifying undergraduate credits to be applied to the M.I.A. degree elective requirements. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser.

DEGREE REQUIREMENTS

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.A. in GLIS are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.I.A. degree are listed on the Degree Requirements tab. If students accepted into the IUG program are unable to complete the M.I.A. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical

time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
ASIA 404H	Topics in Asian Literature	3
ASIA 404Y	Topics in Asian Literature	3
ASIA 424	Transnational Korean Literature	3
AFR/PLSC 443	Ethnic Conflict in Africa	3
CED 425	International Community and Economic Development	3
ECON 433	Advanced International Trade Theory and Policy	3
GEOG 430	Human Use of Environment	3
HIST 473	The Contemporary Middle East	3
INTAF 804	Global Cultures and Leadership	3
INTAF 890	Colloquium	3
LER 475H		3
PHIL 403	Seminar in Environmental Ethics	3
PLSC 412	International Political Economy	3
PLSC 414	Dictators and Their Demise	3
PLSC 436	Civil Wars	3
PLSC 437	War in World Politics	3
PLSC 439	The Politics of Terrorism	3
PLSC 451	The Politics of Human Rights	3
RLST/SOC 461	Sociology of Religion	3
SOC 422	World Population Diversity	3
SOC 425	Social Conflict	3
WMNST 420W	Gender and International Development	3

INTEGRATED B.S. IN GLOBAL AND INTERNATIONAL STUDIES AND M.I.A. IN INTERNATIONAL AFFAIRS

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Global and International Studies with the M.I.A. in International Affairs offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- University Park

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The integrated undergraduate-graduate (IUG) degree program (B.S. in Global and International Studies/M.I.A. in International Affairs) provides an opportunity for strong students in these majors to complete a master's degree with 5 total years of study.

An increasingly globalized economy is likely to escalate the demand for graduate training in international affairs and career choices for graduates with this training will also expand sharply. The integrated degree program would prepare students for a variety of careers requiring an interdisciplinary background in global and international studies and international affairs. Examples of types of entities hiring in these areas are federal, state, and local governments, international organizations, multinational corporations, international banking and financial institutions, media organizations and journalism, consulting firms, policy research centers, and development assistance programs and foundations. The School of International Affairs (SIA) M.I.A. represents a professional degree designed to prepare students to thrive in these increasingly global career paths.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The number of openings in the integrated B.S./M.I.A. program is limited. Admission will be selective based on specific criteria set by the School of International Affairs. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. Specific requirements:

1. Must be enrolled in the Bachelor of Science in Global and International Studies program.
2. Must apply to and be accepted into The Graduate School and the M.I.A. program in the School of International Affairs. Students must complete the Graduate School application. All applicants will submit one letter of recommendation and a personal statement addressing their reasons for pursuing a graduate degree in international affairs and discussing their plans and goals.
3. Applicants are generally expected to have a minimum overall GPA of 3.5 (on a 4.0 scale) in undergraduate coursework and a minimum GPA of 3.5 in all coursework completed for the major.
4. Must include a plan of study identifying undergraduate credits to be applied to the M.I.A. degree elective requirements. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser.

DEGREE REQUIREMENTS

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.S. in GLIS are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.I.A. degree are listed on the Degree Requirements tab. If students accepted into the IUG program are unable to complete the M.I.A. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses

to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted credits must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
ASIA 404H	Topics in Asian Literature	3
ASIA 404Y	Topics in Asian Literature	3
AFR/PLSC 443	Ethnic Conflict in Africa	3
CED 425	International Community and Economic Development	3
ECON 433	Advanced International Trade Theory and Policy	3
GEOG 430	Human Use of Environment	3
HIST 473	The Contemporary Middle East	3
INTAF 804	Global Cultures and Leadership	3
INTAF 890	Colloquium	3
LER 475H		3
PHIL 403	Seminar in Environmental Ethics	3
PLSC 412	International Political Economy	3
PLSC 414	Dictators and Their Demise	3
PLSC 436	Civil Wars	3
PLSC 437	War in World Politics	3
PLSC 439	The Politics of Terrorism	3
PLSC 451	The Politics of Human Rights	3
RLST/SOC 461	Sociology of Religion	3
SOC 422	World Population Diversity	3
SOC 425	Social Conflict	3
WMNST 420W	Gender and International Development	3

INTEGRATED B.S. IN HEALTH POLICY AND ADMINISTRATION AND M.I.A. IN INTERNATIONAL AFFAIRS

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Health Policy and Administration with the M.I.A. in International Affairs offered at the following campuses:

Undergraduate Degree

- Beaver
- Harrisburg
- Hazelton
- Lehigh Valley
- Mont Alto
- Schuylkill

- Shenago
- University Park
- World Campus

Graduate Degree

- University Park

The graduate portion of this IUG is currently offered as face-to-face residential instruction. While the undergraduate curriculum for this IUG may be completed at multiple campuses, the ease and feasibility of completing the integrated program may be heavily dependent upon the location of the graduate instruction. Please discuss the feasibility of completing the IUG with a representative for the graduate program before beginning the application process.

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The integrated undergraduate-graduate (IUG) degree program (B.S. in Health Policy and Administration/M.I.A. in International Affairs) provides an opportunity for strong students in these majors to complete a master's degree with 5 total years of study.

Access to health-related services and health care is a critical issue around the world, especially in developing countries. Given the complexity of health care delivery in any given country, it is important for students to have access to a program that will provide an interdisciplinary education, leading to interdisciplinary approaches and perspectives. The Bachelor of Science in Health Policy and Administration will provide students with a foundation in health care organization, financing, payment, and assessment skills while the Master of International Affairs will provide them the opportunity to adapt this knowledge to an international location or context. As future global leaders attempting to remedy and resolve some of the world's most challenging issues, this program will help prepare the next generation of health policy professionals to work in an increasingly globalized industry.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The number of openings in the integrated B.S./M.I.A. program is limited. Admission will be selective based on specific criteria set by the School of International Affairs. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. Specific requirements:

1. Must be enrolled in the Bachelor of Science in Health Policy and Administration program.

2. Must apply to and be accepted into The Graduate School and the M.I.A. program in the School of International Affairs. Students must complete the Graduate School application (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>). All applicants will submit one letter of recommendation and a personal statement addressing their reasons for pursuing a graduate degree in international affairs and discussing their plans and goals.
3. Applicants are generally expected to have a minimum overall GPA of 3.5 (on a 4.0 scale) in undergraduate coursework and a minimum GPA of 3.5 in all coursework completed for the major.
4. Must include a plan of study identifying undergraduate credits to be applied to the M.I.A. degree elective requirements. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser.

DEGREE REQUIREMENTS

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.S. in Health Policy and Administration are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.I.A. degree are listed on the Degree Requirements tab. If students accepted into the IUG program are unable to complete the M.I.A. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted credits must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
HPA 401	Comparative Health Systems	3
HPA 445	Health Economics	3
HPA 447	Financing Health Care	3
HPA 455	Strategic Planning and Marketing for Health Services	3
HPA 497	Special Topics (Health Economics in Developing Countries)	3
INTAF 506	International Economics: Principles, Policies, and Practices	3
INTAF 801	Actors, Institutions, and Legal Frameworks in International Affairs	3
INTAF 802	Foundations of Diplomacy and International Relations Theory	3
INTAF 803	Multi-sector and Quantitative Analysis	3
INTAF 804	Global Cultures and Leadership	3
INTAF 890	Colloquium	3

Integrated B.A. in International Politics and M.I.A. in International Affairs

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.A. in International Politics with the M.I.A. in International Affairs offered at the following campuses:

Undergraduate Degree

- University Park
- World Campus

Graduate Degree

- University Park

The graduate portion of this IUG is currently offered as face-to-face residential instruction. While the undergraduate curriculum for this IUG may be completed at multiple campuses, the ease and feasibility of completing the integrated program may be heavily dependent upon the location of the graduate instruction. Please discuss the feasibility of completing the IUG with a representative for the graduate program before beginning the application process.

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The integrated undergraduate-graduate (IUG) degree program (B.A. in International Politics/M.I.A. in International Affairs) provides an opportunity for strong students in International Politics to complete a master's degree with 5 total years of study.

The demand for graduate training in international affairs will grow significantly in the near future along with the burgeoning requirements for international knowledge and professional experience in commerce, humanitarian service, and public affairs. The career choices for graduates with this training will also expand sharply. The integrated degree program prepares students for a variety of careers requiring an interdisciplinary background in politics and international affairs. Examples of types of entities hiring in these areas are federal, state, and local governments, international organizations, multinational corporations, international banking and financial institutions, media organizations and journalism, consulting firms, policy research centers, and development assistance programs and foundations.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The number of openings in the integrated B.A./M.I.A. program is limited. Admission will be selective based on specific criteria set by the School of International Affairs. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students

must have completed at least 15 credits at Penn State to enroll in an IUG. Specific requirements:

1. Must be enrolled in the International Politics B.A. program.
2. Must apply to and be accepted into The Graduate School and the M.I.A. program in the School of International Affairs. Students must complete the Graduate School application (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>). All applicants will submit one letter of recommendation and a personal statement addressing their reasons for pursuing a graduate degree in international affairs and discussing their plans and goals.
3. Although the program has no fixed minimum grade-point average, an applicant is generally expected to have a minimum overall GPA of 3.5 (on a 4.0 scale) in undergraduate course work and a minimum GPA of 3.5 in all course work completed for the major.
4. Must include a plan of study identifying undergraduate credits to be applied to the M.I.A. degree elective requirements. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.
5. Must provide written endorsement from the head of the undergraduate program/department.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Arts in International Politics are listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.I.A. degree are listed on the Degree Requirements tab. If students accepted into the IUG program are unable to complete the M.I.A. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Up to 15 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted credits must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted. The following credits may be double-counted toward the B.A. and the M.I.A.:

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
INTAF 506	International Economics: Principles, Policies, and Practices	3
INTAF 802	Foundations of Diplomacy and International Relations Theory	3
INTAF 804	Global Cultures and Leadership	3
INTAF 890	Colloquium	3
PLSC 412	International Political Economy	3
PLSC 414	Dictators and Their Demise	3
PLSC 420	State Making	3
PLSC 428	Gender and Politics	3

PLSC 436	Civil Wars	3
PLSC 439	The Politics of Terrorism	3
PLSC 443	Ethnic Conflict in Africa	3
PLSC 466	Political Psychology	3
PLSC 467	International Relations of the Middle East	3

Integrated B.A. in Japanese and M.I.A. in International Affairs

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.A. in Japanese with the M.I.A. in International Affairs offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- University Park

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The integrated undergraduate-graduate (IUG) degree program (B.A. in Japanese/M.I.A. in International Affairs) provides an opportunity for strong students in this major to complete a master's degree with 5 total years of study.

An increasingly globalized economy is likely to escalate the demand for graduate training in international affairs. The career choices for graduates with this training will also expand sharply.

The integrated degree program prepares students for a variety of careers requiring an interdisciplinary background in Asian languages and international affairs. Examples of types of entities hiring in these areas are federal, state, and local governments, international organizations, multinational corporations, international banking and financial institutions, media organizations and journalism, consulting firms, policy research centers, and development assistance programs and foundations. The School of International Affairs (SIA) Master of International Affairs (M.I.A.) represents a professional degree designed to prepare students to thrive in these increasingly global career paths.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The number of openings in the integrated B.A./M.I.A. program is limited. Admission will be selective based on specific criteria set by the School of International Affairs. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students

must have completed at least 15 credits at Penn State to enroll in an IUG. Specific requirements:

1. Must be enrolled in the Asian Studies, Chinese, or Japanese B.A. program.
2. Must apply to and be accepted into The Graduate School and the M.I.A. program in the School of International Affairs. Students must complete the Graduate School application (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>). All applicants will submit one letter of recommendation and a personal statement addressing their reasons for pursuing a graduate degree in international affairs and discussing their plans and goals.
3. Although the program has no fixed minimum grade point average, an applicant is generally expected to have a minimum overall GPA of 3.5 (on a 4.0 scale) in undergraduate course work and a minimum GPA of 3.5 in all course work completed for the major.
4. Must include a plan of study identifying undergraduate credits to be applied to the M.I.A. degree elective requirements. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser.
5. Must provide written endorsement from the head of Asian Studies.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Arts in Japanese are listed on the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.I.A. degree are listed on the Degree Requirements tab. If students accepted into the IUG program are unable to complete the M.I.A. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted credits must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
ASIA 400	International Culture in East Asia	3
ASIA 401	Technology & Society in Modern Asia	3
ASIA 430	Japan in the World	3
ASIA 463		
ASIA 465Y	Democratization in Asia	3
ASIA 469	Government and Politics of South Asia	3
ASIA 475Y	The Making and Emergence of Modern India	3
ASIA 481	Modern Japan Since 1800	3
ASIA 486	China in Revolution	3
ASIA 501	Proseminar in Asian Studies I	1-3

ASIA 502	Proseminar in Asian Studies II	1-3
ASIA 577	Critical Perspectives on Modern Chinese Literature	3

Integrated B.A. in Political Science and M.I.A. in International Affairs

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The integrated undergraduate-graduate (IUG) degree program (B.A. in Political Science/M.I.A. in International Affairs) provides an opportunity for strong students in Political Science to complete a master's degree with 5 total years of study.

An increasingly globalized economy is likely to escalate the demand for graduate training in international affairs. The career choices for graduates with this training will also expand sharply. The integrated degree program prepares students for a variety of careers requiring an interdisciplinary background in politics and international affairs. Examples of types of entities hiring in these areas are: federal, state, and local governments, international organizations, multinational corporations, international banking and financial institutions, media organizations and journalism, consulting firms, policy research centers, and development assistance programs and foundations. The School of International Affairs (SIA) Master of International Affairs (M.I.A.) represents a professional degree designed to prepare students to thrive in these increasingly global career paths.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The number of openings in the integrated B.A./M.I.A. program is limited. Admission will be selective based on specific criteria set by the School of International Affairs. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. Specific requirements:

1. Must be enrolled in the Political Science B.A. program.
2. Must apply to and be accepted into The Graduate School and the M.I.A. program in the School of International Affairs. Students must complete the Graduate School application (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>). All applicants will submit one letter of recommendation and a personal statement addressing their reasons for pursuing a graduate degree in international affairs and discussing their plans and goals.
3. Although the program has no fixed minimum grade-point average, an applicant is generally expected to have a minimum overall GPA of 3.5 (on a 4.0 scale) in undergraduate course work and a minimum GPA of 3.5 in all course work completed for the major.
4. Must include a plan of study identifying undergraduate credits to be applied to the M.I.A. degree elective requirements. The plan should cover the entire time period of the integrated program, and it should

be reviewed periodically with an adviser as the student advances through the program.

5. Must provide written endorsement from the head of Political Science.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Arts in Political Science are listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.I.A. degree are listed on the Degree Requirements tab. If students accepted into the IUG program are unable to complete the M.I.A. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Up to 15 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted credits must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted. The following credits may be double-counted toward the B.A. and the M.I.A.:

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
INTAF 506	International Economics: Principles, Policies, and Practices	3
INTAF 802	Foundations of Diplomacy and International Relations Theory	3
INTAF 804	Global Cultures and Leadership	3
INTAF 890	Colloquium	3
PLSC 412	International Political Economy	3
PLSC 414	Dictators and Their Demise	3
PLSC 420	State Making	3
PLSC 428	Gender and Politics	3
PLSC 436	Civil Wars	3
PLSC 439	The Politics of Terrorism	3
PLSC 443	Ethnic Conflict in Africa	3
PLSC 466	Political Psychology	3
PLSC 467	International Relations of the Middle East	3

Integrated B.A. in Russian and M.I.A. in International Affairs

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.A. in Russian with the M.I.A. in International Affairs offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- University Park

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The integrated undergraduate-graduate (IUG) degree program (B.A. in Russian/M.I.A. in International Affairs) provides an opportunity for strong students in this major to complete a master's degree with 5 total years of study.

An increasingly globalized economy is likely to escalate the demand for graduate training in international affairs. The career choices for graduates with this training will also expand sharply. The integrated degree program prepares students for a variety of careers requiring an interdisciplinary background in Russian and international affairs. Examples of types of entities hiring in these areas are federal, state, and local governments, international organizations, multinational corporations, international banking and financial institutions, media organizations and journalism, consulting firms, policy research centers, and development assistance programs and foundations. The School of International Affairs (SIA) Master of International Affairs (M.I.A.) represents a professional degree designed to prepare students to thrive in these increasingly global career paths.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The number of openings in the integrated B.A./M.I.A. program is limited. Admission will be selective based on specific criteria set by the School of International Affairs. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. Specific requirements:

1. Must be enrolled in the Russian B.A. program.
2. Must apply to and be accepted into The Graduate School and the M.I.A. program in the School of International Affairs. Students must complete the Graduate School application (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>). All applicants will submit one letter of recommendation and a personal statement addressing their reasons for pursuing a graduate degree in international affairs and discussing their plans and goals.
3. Although the program has no fixed minimum grade point average, an applicant is generally expected to have a minimum overall GPA of 3.5 (on a 4.0 scale) in undergraduate course work and a minimum GPA of 3.5 in all course work completed for the major.
4. Must include a plan of study identifying undergraduate credits to be applied to the M.I.A. degree elective requirements. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser.

5. Must provide written endorsement from the head of Germanic and Slavic Languages and Literatures.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Arts in Russian are listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.I.A. degree are listed on the Degree Requirements tab. If students accepted into the IUG program are unable to complete the M.I.A. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted credits must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
RUS 400		
RUS 405	Seminar in Russian Literature	3-6
RUS 406	Russian Film	3
RUS 412	Russian Translation	3
RUS 494	Research Project	1-12
RUS 501	Readings in Russian Literature	3-6
INTAF 802	Foundations of Diplomacy and International Relations Theory	3
INTAF 804	Global Cultures and Leadership	3

Integrated B.S. in Security and Risk Analysis and M.I.A. in International Affairs

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Security and Risk Analysis with the M.I.A. in International Affairs offered at the following campuses:

Undergraduate Degree

- Altoona
- Berks
- Harrisburg
- University Park

Graduate Degree

- University Park

The graduate portion of this IUG is currently offered as face-to-face residential instruction. While the undergraduate curriculum for this IUG

may be completed at multiple campuses, the ease and feasibility of completing the integrated program may be heavily dependent upon the location of the graduate instruction. Please discuss the feasibility of completing the IUG with a representative for the graduate program before beginning the application process.

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The integrated undergraduate-graduate (IUG) degree program (B.S. in Security and Risk Analysis/M.I.A. in International Affairs) provides an opportunity for strong students in these majors to complete a master's degree with 5 total years of study.

Persistent advanced threats to cyber networks; transnational threats such as climate, migration, poverty, and energy sustainability; hybrid-war strategies; and non-state actors' seeking to cause chaos by compromising cyber-space create an evolving international threat environment that challenges the balance between security and privacy and requires experience in intelligence analysis and knowledge of threats and vulnerabilities pertaining to cybersecurity. Identifying and mitigating the prevalent threats and vulnerabilities associated with the new age requires critical thinkers who are the product of interdisciplinary education. Collaboration between the College of Information Sciences and Technology (IST) and the School of International Affairs (SIA) positions Penn State to provide a program that prepares the next generation to prepare for, respond to, mitigate, and recover from the threats posed by this dynamic international environment.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The number of openings in the integrated B.S./M.I.A. program is limited. Admission will be selective based on specific criteria set by the School of International Affairs. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. Specific requirements:

1. Must be enrolled in the Security and Risk Analysis B.S. program.
2. Must apply to and be accepted into The Graduate School and the M.I.A. program in the School of International Affairs. Students must complete the Graduate School application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>). All applicants will submit one letter of recommendation and a personal statement addressing their reasons for pursuing a graduate degree in international affairs and discussing their plans and goals.
3. Although the program has no fixed minimum grade point average, an applicant is generally expected to have a minimum overall GPA of 3.5 (on a 4.0 scale) in undergraduate coursework and a minimum GPA of 3.5 in all coursework completed for the major.
4. Must include a plan of study identifying undergraduate credits to be applied to the M.I.A. degree elective requirements. The plan should

cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser.

5. Must provide written endorsement from the Associate Dean of the College of Information Sciences and Technology.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.S. in Security and Risk Analysis are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.I.A. degree are listed on the Degree Requirements tab. If students accepted into the IUG program are unable to complete the M.I.A. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted credits must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
SRA 421	The Intelligence Environment	3
SRA 433	Deception and Counterdeception	3
SRA 440W	Security and Risk Analysis Capstone Course	3
SRA 468	Spatial Analysis of Risks	3
INTAF 801	Actors, Institutions, and Legal Frameworks in International Affairs	3
INTAF 802	Foundations of Diplomacy and International Relations Theory	3
INTAF 804	Global Cultures and Leadership	3

INTEGRATED B.A. IN SOCIOLOGY AND M.I.A. IN INTERNATIONAL AFFAIRS

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.A. in Sociology with the M.I.A. in International Affairs offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- University Park

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The integrated undergraduate-graduate (IUG) degree program (B.A. in Sociology/M.I.A. in International Affairs) provides an opportunity for strong students in these majors to complete a master's degree with 5 total years of study.

In an increasingly globalized world, this interdisciplinary program can help provide students with a foundation in a variety of sociological topics while viewing them in the international context. Examples of the types of entities that graduates of this program may pursue careers at include federal, state, and local governments, non-governmental organizations, international organizations, intergovernmental organizations, multinational corporations, consulting firms, and policy research centers. As future global leaders attempting to remedy and resolve some of the world's most challenging issues, this program can help to prepare students for their careers.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The number of openings in the integrated B.A./M.I.A. program is limited. Admission will be selective based on specific criteria set by the School of International Affairs. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. Specific requirements:

1. Must be enrolled in the Bachelor of Arts in Sociology program.
2. Must apply to and be accepted into The Graduate School and the M.I.A. program in the School of International Affairs. Students must complete the Graduate School application. All applicants will submit one letter of recommendation and a personal statement addressing their reasons for pursuing a graduate degree in international affairs and discussing their plans and goals.
3. Applicants are generally expected to have a minimum overall GPA of 3.5 (on a 4.0 scale) in undergraduate coursework and a minimum GPA of 3.5 in all coursework completed for the major.
4. Must include a plan of study identifying undergraduate credits to be applied to the M.I.A. degree elective requirements. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser.

DEGREE REQUIREMENTS

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.A. in Sociology are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.I.A. degree are listed on the Degree Requirements tab. If students accepted into the IUG program are unable to complete the M.I.A. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must

apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted credits must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
SOC 400W	Senior Research Seminar	3
SOC 405	Sociological Theory	3
SOC 408	Urban Ecology	3
SOC 409	Racial and Ethnic Inequality in America	3
SOC 412	Crime, Social Control, and the Legal System	3
SOC 419	Race and Public Policy	3
SOC 422	World Population Diversity	3
SOC 423	Social Demography	3
SOC 424	Social Change	3
SOC 425	Social Conflict	3
SOC 432	Social Movements	3
SOC 445	U.S. Immigration	3
SOC 446	Political Sociology	3
SOC 461	Sociology of Religion	3
SOC 470	Intermediate Social Statistics	4
INTAF 801	Actors, Institutions, and Legal Frameworks in International Affairs	3
INTAF 804	Global Cultures and Leadership	3
INTAF 890	Colloquium	3

INTEGRATED B.S. IN SOCIOLOGY AND M.I.A. IN INTERNATIONAL AFFAIRS

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Sociology with the M.I.A. in International Affairs offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- University Park

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The integrated undergraduate-graduate (IUG) degree program (B.S. in Sociology/M.I.A. in International Affairs) provides an opportunity for strong students in these majors to complete a master's degree with 5 total years of study.

In an increasingly globalized world, this interdisciplinary program can help provide students with a foundation in a variety of sociological topics while viewing them in the international context. Examples of the types

of entities that graduates of this program may pursue careers at include federal, state, and local governments, non-governmental organizations, international organizations, intergovernmental organizations, multinational corporations, consulting firms, and policy research centers. As future global leaders attempting to remedy and resolve some of the world's most challenging issues, this program can help to prepare students for their careers.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The number of openings in the integrated B.S./M.I.A. program is limited. Admission will be selective based on specific criteria set by the School of International Affairs. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. Specific requirements:

1. Must be enrolled in the Bachelor of Science in Sociology program.
2. Must apply to and be accepted into The Graduate School and the M.I.A. program in the School of International Affairs. Students must complete the Graduate School application. All applicants will submit one letter of recommendation and a personal statement addressing their reasons for pursuing a graduate degree in international affairs and discussing their plans and goals.
3. Applicants are generally expected to have a minimum overall GPA of 3.5 (on a 4.0 scale) in undergraduate coursework and a minimum GPA of 3.5 in all coursework completed for the major.
4. Must include a plan of study identifying undergraduate credits to be applied to the M.I.A. degree elective requirements. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser.

DEGREE REQUIREMENTS

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.S. in Sociology are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>).

Degree requirements for the M.I.A. degree are listed on the Degree Requirements tab. If students accepted into the IUG program are unable to complete the M.I.A. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted credits must be at the 500 or 800 level. Independent

study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
SOC 400W	Senior Research Seminar	3
SOC 405	Sociological Theory	3
SOC 408	Urban Ecology	3
SOC 409	Racial and Ethnic Inequality in America	3
SOC 412	Crime, Social Control, and the Legal System	3
SOC 419	Race and Public Policy	3
SOC 422	World Population Diversity	3
SOC 423	Social Demography	3
SOC 424	Social Change	3
SOC 425	Social Conflict	3
SOC 432	Social Movements	3
SOC 445	U.S. Immigration	3
SOC 446	Political Sociology	3
SOC 461	Sociology of Religion	3
SOC 470	Intermediate Social Statistics	4
INTAF 801	Actors, Institutions, and Legal Frameworks in International Affairs	3
INTAF 804	Global Cultures and Leadership	3
INTAF 890	Colloquium	3

Joint Degrees

Joint J.D./M.I.A. with Penn State Law

Requirements listed here are in addition to requirements listed in GCAC-211 Joint Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-211-joint-degree-programs/>).

Penn State Law and the School of International Affairs (SIA) offer a joint degree program that enables a student to complete in four academic years both a Juris Doctor degree (J.D.) and a Master of International Affairs (M.I.A.). A J.D./M.I.A. graduate will have the education and skills background to practice law in the United States, to work in an international context, and to assume a leadership role in international affairs.

Admission Requirements

Students must apply to and meet the admission requirements of both the graduate program in which they intend to receive their graduate degree and the professional degree program. Upon the student's request and at the discretion of the program, LSAT scores may be accepted in place of GRE scores for joint degree admission purposes. Admissions requirements and applications for admission to Penn State Law are available at the J.D. Admissions (<https://pennstatelaw.psu.edu/penn-state-law-jd-admissions/>) section of the Penn State Law website.

Students applying to the joint degree program must be admitted separately into both Penn State Law and the School of International Affairs.

Residency

A typical J.D./M.I.A. joint degree student will be in residence at Penn State Law for six semesters and at SIA for two semesters.

Liaisons

The respective liaisons for Penn State Law and SIA shall be as follows: the department and faculty liaisons for Penn State Law shall be the Associate Dean for Academic Affairs and the student adviser will be the Associate Dean for Academic Affairs or such other faculty member(s) as may be designated by the Dean. The liaison for SIA shall be the Director or such faculty member(s) as may be designated by the Director.

Double-Counting of Credits Penn State Law

A maximum of twelve credits of M.I.A. course work may be double-counted for credit toward the J.D. degree at Penn State Law. Courses eligible for double-counting towards the J.D. and M.I.A. include the courses on the M.I.A. Electives list and any other courses taken as M.I.A. electives with the express written permission of the M.I.A. and J.D. advisers. Students must obtain a grade satisfactory to Penn State Law for the course work to be credited towards the J.D. degree.

SIA

A maximum of twelve credits of law school course work may be double-counted for credit toward the M.I.A. degree. Courses eligible for double-counting towards the J.D. and M.I.A. include the courses on the M.I.A. Electives list and any other courses taken as M.I.A. electives with the express written permission of the M.I.A. and J.D. advisers.

Sequence

Joint Degree students will complete their SIA core courses by the end of the second year of the joint degree program. The third and fourth year of the joint program will be in residence with Penn State Law and will include both required law classes and remaining electives to fulfill the M.I.A.

Recommended Program of Study and Advising

All students in the program will have two advisers, one from Penn State Law and one from SIA. Periodic interaction between the two advisers is encouraged. A program of study is developed for each student, taking into account the fact that some courses at both locations are offered on a rotating or intermittent basis. Many courses are offered every year but some are offered every two or three years. Advisers will have available a list of projected relevant courses or educational experiences in order to work with the student on an individualized program of study. The standard committee structure will apply to the SIA programs.

Tuition

Students will be charged the applicable Penn State Law tuition to cover the J.D. program and the applicable SIA tuition to cover the M.I.A. degree program. The Penn State Law tuition will be paid for the semesters that the student is in residence at Penn State Law, and the SIA tuition will be paid for the semesters that the student is in residence there. A student may take up to one course (3 credit hours) per semester in the school where the student is not in residence without any change in tuition, but must pay additional tuition to the non-residential program if he or she wishes to take additional course work in that program during that semester.

Financial Aid and Assistantships

Decisions on financial aid and assistantships are made by each school according to that school's procedures. Students on graduate assistantships must adhere to the course load limits (<http://gradschool.psu.edu/graduate-education-policies/gsad/credit-loads-graduate-assistants/>) set by The Graduate School.

Fulfillment of Degree Requirements and Graduation

A student in the program may complete the requirements for one of the degrees and be awarded that degree prior to completing all the requirements for the other degree; provided, however, that the student shall have successfully completed at least two semesters of work towards the other degree. All courses in one program that will count towards meeting the requirements of the other must be completed before the awarding of either degree. Students will be required to fulfill all requirements for each degree in order to be awarded that degree, subject to the inter-program transfer of credits. If students accepted into the joint degree program are unable to complete the J.D. degree, they are still eligible to receive the M.I.A. degree if all the M.I.A. degree requirements have been satisfied.

Important Note: If the joint degree student is using law (900-level) credits toward the graduate degree during their last semester of enrollment, they should be prepared to extend their graduate degree graduation to a subsequent semester (the following semester at a minimum). This is due to the graduate degree approval deadline falling before the law (900-level) course grading processes are complete.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

International Affairs (INTAF) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/intaf/>)

Learning Outcomes

1. **KNOW:** International Affairs students will demonstrate a basic cross-disciplinary knowledge of the components and dynamics of the international system, international economics, international actors and institutions, and processes of globalization.
2. **KNOW:** International Affairs students will acquire concentrated knowledge in a specific area of focus that will enable them to respond creatively and effectively to local and global challenges.
3. **APPLY/CREATE:** International Affairs students will develop techniques of research in International Affairs.
4. **COMMUNICATE:** International Affairs will demonstrate competence in the techniques of scholarly writing in international affairs.
5. **COMMUNICATE:** International Affairs will develop skills in oral and written communication to articulate ideas and arguments clearly and effectively.
6. **COMMUNICATE:** International Affairs students will demonstrate competence at the ACTFL intermediate level or higher in the use of a modern foreign language.
7. **THINK:** International Affairs students will be able to analyze an international problem or issue in a manner that demonstrates global or regional understanding and sensitivity to cultural difference.
8. **PROFESSIONAL PRACTICE/ETHICS:** International Affairs students will develop the capacities for self-reflection, ethical reasoning and effective interaction with others so as to act responsibly and to promote justice and sustainability in professional and communal life.

Contact

Campus	University Park
Graduate Program Head	Mitchell P Smith
Program Contact	Christie Persio 250D Lewis Katz University Park PA 16802 czp76@psu.edu (814) 863-0788
Program Website	View (http://www.sia.psu.edu)

International Agriculture and Development

Graduate Program Head	Paul Esker
Program Code	INTAD
Campus(es)	University Park
Degrees Conferred	Dual-Title
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=INTAD)

Students electing this degree program through participating programs will earn a degree with a dual-title at the Master's or Ph.D. level. Students receive a degree that lists their major program and International Agriculture and Development (INTAD).

The International Agriculture and Development (INTAD) program is offered through the Departments of Agricultural Economics, Sociology,

and Education, Entomology, Forest Resources, Environmental Systems Management, Plant Pathology and Environmental Microbiology, and Plant Sciences. The dual-title degree enables qualified students from the College of Agricultural Sciences (CAS) and other select programs at Penn State to combine their major degree with an internationally focused program of study to gain global competency skills and techniques for application of their discipline in a global environment.

The following graduate programs offer the dual-title in INTAD:

- M.S. and Ph.D. in Agricultural and Biological Engineering (ABENG)
- M.S. and Ph.D. in Agricultural and Environmental Plant Science (AEPS)
- M.S. and Ph.D. in BioRenewable Systems (BRS)
- M.S. and Ph.D. in Civil Engineering (CE)
- M.S. and Ph.D. in Ecology (ECLGY)
- M.S. and Ph.D. in Education, Development, and Community Engagement (EDCE)
- M.S. and Ph.D. in Entomology (ENT)
- M.S. and Ph.D. in Food Science (FDSC)
- M.S. and Ph.D. in Forest Resources (FORR)
- M.S. and Ph.D. in Plant Pathology (PPATH)
- M.S. and Ph.D. in Rural Sociology (RSOC)
- M.S. and Ph.D. in Soil Sciences (SOILS)

The INTAD dual-title graduate degree program is administered by the INTAD Academic Program Committee. The committee maintains the curriculum, identifies courses appropriate for the program, and develops and recommends policy and procedures for the program's operation to the dean of the College of Agricultural Sciences and the dean of the Graduate School. Members of the Graduate Faculty in INTAD also serve on master's and doctoral committees for students who are accepted into the dual-title program. This dual-title program enables students to learn about international agriculture while maintaining a close association with their primary area of interest in their home department.

Admission Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Students must apply and be admitted to their primary graduate program and The Graduate School before they can apply for admission to the INTAD dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of INTAD dual-title program. The student will submit an application to the INTAD Academic Program Committee. The application will include a written personal statement indicating the career goals they hope to accomplish by earning a dual-title degree. Doctoral students must be admitted into the dual-title degree program in INTAD no later than the end of the fourth semester (not counting summer semesters) of entry into the graduate major program.

Degree Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

To qualify for the INTAD dual-title degree, students must satisfy the requirements of the primary graduate program in which they are enrolled. In addition, they must satisfy the minimum requirements of the INTAD dual-title degree specified here.

Graduates of the dual-title INTAD master's degree program who wish to pursue an INTAD doctoral degree must re-apply to the INTAD program for admission. INTAD master's degree credits may be carried over to the doctoral program. Six additional INTAD credits will be required. INTAD master's degree graduates who pursue an INTAD Ph.D. are required to take INTAD 820 a second time.

Master's Degrees

Course Requirements

Students are required to complete a minimum of 13 INTAD course credits (400, 500, or 800) for a dual-title master's degree. Ten credits will form the core curriculum:

Code	Title	Credits
Required Courses		
INTAD 820	International Agricultural Development Seminar	3
RSOC 517	International Rural Social Change	3
INTAD 577	Global Agricultural Systems	3
INTAD 590	Colloquium	1
Electives		
The remaining three credits must be taken as an internship or applied course/independent study with international development content.		3
Total Credits		13

Final course selection is determined by the students, their major program advisers and their INTAD advisers. These advisers will discuss with the student a program of study that meets the student's career goals and that is in accord with the policies of the Graduate Council and the INTAD dual-title program. Some courses may satisfy both the major graduate program requirements and those of the INTAD dual-title program.

Thesis

Students pursuing a M.S. degree that requires a master's thesis, in addition to the 13 credits specified above, must write the thesis on a topic that reflects both their primary graduate program and the dual-title in INTAD. At least 6 thesis research credits (600 or 610) must be taken in the student's primary graduate program.

All members of the student's committee for the dual-title master's degree will be members of the Graduate Faculty. The committee must include at least one Graduate Faculty member from INTAD.

Doctoral Degrees

Students admitted to the doctoral INTAD dual-title offering must exhibit high research competence, including ability to identify, conceptualize, and execute a significant research project that makes a significant addition to the body of knowledge in the field. Students also must be fluent in reading, writing, and speaking English.

Course Requirements

Students are required to complete a minimum of 19 INTAD credits for a dual-title Ph.D. degree. The 19 required credits must be at the 500 or 800 level. Thirteen credits will form the core curriculum:

Code	Title	Credits
Required Courses		
INTAD 820	International Agricultural Development Seminar	3
RSOC 517	International Rural Social Change	3
INTAD 577	Global Agricultural Systems	3
EDCE 525	Program Design and Delivery	3
INTAD 590	Colloquium	1
Electives		
Three credits must be taken as an internship or applied course/independent study with international development content.		3
Three credits must be taken from among the INTAD electives.		3
Total Credits		19

In addition, students will be encouraged to pursue proficiency in a language other than English, as appropriate.

Final course selection is determined by the students and their Ph.D. committees. The Ph.D. committee will discuss with the student a program of study that meets the student's career goals and that is in accord with the policies of the Graduate Council and the INTAD dual-title program. Some courses may satisfy both the major graduate program requirements and those of the INTAD dual-title program. Permission from a student's Ph.D. committee, in consultation with the program chair, is required to substitute a 400-level course for a 500-level course.

Qualifying Examination

The qualifying examination committee for the dual-title Ph.D. degree must include at least one Graduate Faculty member from INTAD program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. It is preferred that students take a single qualifying examination, containing elements of both the primary program and INTAD. However, in cases when students matriculate into a dual-title after they have already completed the primary program qualifying exam, a second qualifying exam may be taken for the dual title, according to policy GCAC-604 and the guidelines of the dual-title program.

Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

Committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of an INTAD dual-title doctoral degree student must include at least one member of the INTAD Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in INTAD, the member of the committee representing INTAD must be appointed as co-chair.

Comprehensive Exam

At the end of their course work, students must pass a comprehensive examination that follows the guidelines established by the primary program and reflects both their primary program and the dual-title degree curriculum. International agriculture must be one of the key areas of the exam and the INTAD representative on the student's Ph.D. committee

must have input into the development of and participate in the evaluation of the comprehensive evaluation.

Dissertation and Dissertation Defense

Doctoral students enrolled in the dual-title degree program are required to write and orally defend a dissertation on a topic that reflects their original research and education in both their primary program and the INTAD dual-title program. The dissertation should contribute to the body of knowledge in international agriculture. A public oral presentation of the dissertation is required. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School, and the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

A limited number of Research Assistantships are also available through the College of Agricultural Sciences.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

International Agricultural Development (INTAD) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/intad/>)

Learning Outcomes

1. **KNOW** – In addition to competency in the core discipline, INTAD graduates will demonstrate in-depth knowledge of political, economic, social and environmental components of global food systems.
2. **THINK** – In addition to competency in the core discipline, INTAD graduates will learn, critically evaluate and apply diverse perspectives to complex subjects within natural and human systems.
3. **APPLY/CREATE** – In addition to competency in the core discipline, INTAD graduates will apply knowledge and skills to implement sophisticated, appropriate and workable solutions to address complex global agricultural problems using interdisciplinary perspectives in both independent and collaborative situations.
4. **COMMUNICATE** – In addition to competency in the core discipline, INTAD graduates will be able to identify, organize and synthesize information from appropriate scholarly sources, engage in collaboration with diverse partners, and effectively communicate the critical issues of global food issues with diverse audiences.
5. **PROFESSIONAL PRACTICE** - In addition to competency in the core discipline, INTAD graduates will take informed and responsible action to address ethical, social and environmental challenges in global food systems and evaluate the local and broader consequences of individual and collective interventions.

Contact

Campus	University Park
Graduate Program Head	Paul David Esker
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Leland Luther Glenna
Program Contact	Melanie Joy Miller Foster 106 Ag Admin University Park PA 16802 mjm727@psu.edu (814) 867-3831
Program Website	View (http://agsci.psu.edu/international/graduatestudents/intad/)

Kinesiology

Graduate Program Head	Nancy I. Williams
Program Code	KINES
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Dual-Title Ph.D. in Kinesiology and Bioethics Dual-Title Ph.D. in Kinesiology and Clinical and Translational Sciences
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=KINES)

The graduate programs in Kinesiology are research oriented and are designed to meet the specific goals and interests of the student. The primary goal of the overall program is to provide students the opportunity to study in depth one area of specialization and to develop necessary research skills to enhance their professional competence. The master's program is designed to prepare students for future graduate study,

while the doctoral program is directed toward careers in research and in teaching at the advanced undergraduate and graduate levels in colleges and universities. Six areas of study are available at both the master's and doctoral levels:

1. Athletic training and sports medicine
2. Biomechanics
3. Exercise physiology
4. History and philosophy of sport
5. Motor control
6. Psychology of physical activity

Several well-equipped research facilities are available to support graduate study, including the Biomechanics Laboratory, Motor Behavior Laboratory, and Noll Physiological Research Center.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The minimum requirements for admission to the master's program include:

- a 3.00 junior/senior grade-point average (on a 4.00 scale),
- satisfactory recommendations,
- and appropriate background courses in physical, biological, behavioral, and/or social science, depending on the intended area of specialization.

Applicants from majors other than exercise and sport science/physical education are welcome to apply. In addition, doctoral applicants are expected to meet more stringent admission standards, including documented research capabilities (e.g., from an M.S. degree). Experience is highly desirable. Admission is highly competitive and the best-qualified students will be admitted subject to space availability and compatibility of the student with the department's research mission. GRE scores are not required for admission.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The M.S. program of study in the Department of Kinesiology requires a minimum of 30 credits, including:

Code	Title	Credits
Required Courses		
6 credits from the six Department of Kinesiology areas of graduate study ¹		6
6 credits of classes offered outside the Department of Kinesiology ¹		6
KINES 590	Colloquium (two semesters)	2
Electives		
10 elective credits		10
Culminating Experience		

KINES 600	Thesis Research	6
Total Credits		30

¹ For all of which the student must receive a quality letter grade.

Each specialization may require additional, specific courses. At least 18 credits in the 500 and 600 series combined must be included in the program. A minimum of 12 credits in course work (400, 500, and 800 series), as contrasted with research, must be completed in the major.

M.S. degree students must complete Scholarship and Research Integrity (SARI) Training (10 hours) and demonstrate proficiency in the English language.

The M.S. degree also requires the formation of a master's committee, the writing of a satisfactory thesis accepted by the master's committee, the head of the graduate program, and the Graduate School, and the passing of a thesis defense. The final public oral examination, conducted by the student's committee members, must be scheduled and passed after all other work, including the M.S. thesis, has been completed.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A program to meet the individual needs of each student is planned with the adviser in consultation with the Ph.D. committee members. Regardless of the area of study, the following are required of all Kinesiology doctoral degree candidates:

Code	Title	Credits
Required Courses		
15 credits from the six Department of Kinesiology areas of graduate study ^{1, 2}		15
6 credits of classes offered outside the Department of Kinesiology ¹		6
KINES 590	Colloquium (all semesters until after the comprehensive exam has been passed)	Varies
Scholarship and Research Integrity (SARI) training (10 hours)		
Total Credits		21

¹ For all of which the student must receive a quality letter grade.

² A maximum of six (6) credits only from KINES 596 Independent Studies may count toward the 15 departmental credits required for the degree.

Beyond this minimum of 21 credits, the student's adviser, and Ph.D. committee in consultation with the student set the structure and content of the doctoral program. A student's Ph.D. committee can require additional course work depending on the student's background and research plans. A maximum of six (6) credits only from Independent Studies may count toward the 15 departmental credits required for the degree.

All doctoral students must pass a qualifying examination, a comprehensive written and oral examination, and a final oral examination (the dissertation defense). To earn the Ph.D. degree, doctoral students must also write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Titles

Dual-Title Ph.D. in Kinesiology and Bioethics

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Kinesiology Ph.D. students may pursue additional training in bioethics through the dual-title Ph.D. program in Bioethics.

Admission Requirements

Students must apply and be admitted to the graduate program in Kinesiology and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Bioethics dual-title program. Refer to the Admission Requirements section of the Bioethics Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/bioethics/>). Doctoral students must be admitted into the dual-title degree program in Bioethics prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the Ph.D. degree in Kinesiology, listed in the Doctoral Degree Requirements section. In addition, students must complete the degree requirements for the dual-title in Bioethics, listed on the Bioethics Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/bioethics/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Kinesiology and must include at least one Graduate Faculty member from the Bioethics program. Unless this requirement is waived by the Bioethics Graduate Director, the committee must include one member of the Bioethics Program who is not also a member of Kinesiology faculty. There will be a single qualifying examination, containing elements of both Kinesiology and Bioethics. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>), the Ph.D. committee of a Kinesiology and Bioethics dual-title Ph.D. student must include at least one member of the Bioethics Graduate Faculty. Unless this requirement is waived by the Bioethics Graduate Director, the committee must include one member of the Bioethics Program who is not also a member of Kinesiology faculty. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Bioethics, the member of the committee representing Bioethics must be appointed as co-chair. The Bioethics representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Kinesiology and Bioethics. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by

the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title Ph.D. in Kinesiology and Clinical and Translational Sciences

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Doctoral students with research and educational interests in clinical and translational science may apply for the Dual-Title Ph.D. Degree in Kinesiology and Clinical and Translational Sciences following admission to the Graduate School and Kinesiology and prior to taking the qualifying examination in Kinesiology. An admissions committee comprised of faculty affiliated with the dual-title program will evaluate applicants. Applicants must have a graduate GPA of at least 3.5 in a research area related to human health. Prospective dual-title program students will write a statement of purpose that addresses the ways in which their research and professional goals will be enhanced by an interdisciplinary course of study in clinical and translational sciences.

This dual-title degree program emphasizes interdisciplinary scholarship at the interface of basic sciences, clinical sciences, and human health. Students in the dual-title program are required to have two advisers from separate disciplines: one individual serving as the primary mentor in the Graduate Program in Kinesiology and another individual serving as the secondary mentor in an area covered by the dual-title program who is a member of the Clinical and Translational Sciences faculty.

To qualify for the dual-title degree in Kinesiology and Clinical and Translational Sciences, students must satisfy the Kinesiology Ph.D. degree requirements listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual-title in Clinical and Translational Sciences, listed on the Clinical and Translational Sciences Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/clinical-translational-sciences/>). At least half of the 18 elective credits required must be at the 500 or 800 level. Up to 12 credits of course work may overlap with required elective courses of the Graduate Program in Kinesiology.

For students in the dual-title program, the qualifying examination will include content from both Kinesiology and Clinical and Translational Sciences, and must be completed within four semesters (summer sessions do not count) of entry into the Kinesiology graduate program. The qualifying examination committee must include at least one member of the Clinical and Translational Sciences Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>), the Ph.D. committee of a Kinesiology and Clinical and Translational Sciences dual-title Ph.D. student must include at least one member of the CTS Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Clinical and Translational Sciences, the member of the committee representing Clinical and Translational Sciences must be appointed as co-chair. The fields of Kinesiology and CTS will be integrated in the student's comprehensive exam, and the Ph.D. committee member

representing CTS is responsible for constructing and grading the parts of the comprehensive exam that cover the CTS field of study.

Dual-title Ph.D. students must complete a dissertation on a topic that reflects their original research and education in both Kinesiology and Clinical and Translational Sciences. In order to earn the dual-title Ph.D. degree, the dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School, and the student must pass a final oral examination (the dissertation defense).

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Kinesiology (KINES) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/kines/>)

Learning Outcomes

Master of Science (M.S.)

1. Graduates will be able to demonstrate mastery of core principles and methods in one of the six graduate areas of study in the Department of Kinesiology.

2. Graduates will be able to critically analyze work by others on their field of specialty.
3. Graduates will be able to carry out an original research project and disseminate their research effectively via publication and/or presentation.
4. Graduates will demonstrate the ability to work in a collegial and ethical manner with other professionals within their own sub-discipline and across other kinesiology sub-disciplines.

Doctor of Philosophy (Ph.D.)

1. Graduates will demonstrate in-depth knowledge of the theories and methods of one of the six graduate areas of study in the Department of Kinesiology.
2. Graduates will be able to critically analyze work by others in their field of specialty.
3. Graduates will be able to identify worthwhile research questions and plan research studies to address these questions.
4. Graduates will be able to carry out multiple original and independent research studies and disseminate their research effectively via publication and/or presentation.
5. Graduates will demonstrate the ability to work in a collegial and ethical manner with other professionals within their own sub-discipline and across other kinesiology sub-disciplines and across disciplines outside of kinesiology.

Contact

Campus	University Park
Graduate Program Head	Nancy Williams
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Jonathan Bates Dingwell
Program Contact	Shari Grassi 276 Recreation Building Penn State University University Park PA 16802 slg19@psu.edu (814) 863-0847
Program Website	View (https://hhd.psu.edu/kines/graduate/graduate-program-mission/)

Labor and Global Workers' Rights

Graduate Program Head	Elaine Hui
Program Code	LGWR
Campus(es)	University Park (M.P.S.)
Degrees Conferred	Master of Professional Studies (M.P.S.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=LGWR)

Labor and Global Workers' Rights is a Master of Professional Studies (M.P.S.) program of study for professionals working in the area of global labor and workers' rights issues who would like to continue or pursue a career working on global labor and worker rights with a national or international labor union or a related organization, such as a labor research institute.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students who do not have a GPA of 3.0 or higher will be considered on a case-by-case basis depending on the quality of their overall application. Applicants who are still completing their baccalaureate/postsecondary requirements at the time of application may be admitted to the Graduate School provisionally (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/provisional-admission/>) based on the awarding of the baccalaureate degree. Students are also expected to have a minimum of three years of full-time work experience in some area related to labor unions or worker-oriented research/employment for admission. Exceptions may be made by the program chair.

Admissions decisions for the program are based on the quality of the applicant's credentials as determined by a review of the complete application portfolio. During the admission process, students who seem better suited for a different graduate program will be encouraged to apply to the appropriate program. Applicants to the M.P.S. in LGWR must submit the following materials:

- Completed online Penn State Graduate School application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) and payment of the nonrefundable application fee;
- A personal statement explaining your educational and career goals and interests and how our program will help you achieve your goals;
- A resume;
- Three letters of recommendation;
- official transcripts from all post-secondary institutions attended. (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>)

Graduate Record Examination (GRE) scores are not required.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

If scores are needed, applicants must request that the testing center to send their official results to Penn State University (Code 2660. Department: "For any other department not listed.")

For more information on the admission process, see: Admission (<https://ler.la.psu.edu/graduate/mps-in-labor-and-global-workers-rights/admission-process/>).

Degree Requirements

Master of Professional Studies (M.P.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Total Required Credits for the MPS: 30 credits at the 400, 500, or 800 level; at least 18 credits must be at the 500 or 800 level, with at least 6

credits at the 500 level. A culminating experience is required (3 credits of LGWR 894 are included in the 30 total required credits).

Code	Title	Credits
Required Courses		
HRER 500	Topics in Comparative Industrial Relations	3
HRER 513	Research Methods in Human Resources and Employment Relations II	3
LHR 475H	Labor in the Global Economy	3
LGWR 510	International Labor Law	3
LGWR 520	Global Workers' Rights	3
Select one of the following:		3
LGWR 895	Internship (strongly recommended)	
LGWR 596	Individual Studies	
Other 3 credit course approved in advance by the program chair		
Electives		
Select 9 credits of the following:		9
HIST 556	American Social and Cultural History	
HRER 504	Seminar in Employment Relations	
HRER 512	Research Methods and Analytics in Human Resources and Employment Relations	
HRER 516	Labor Market Analysis	
HRER 536	Diversity in the Workplace	
LHR 435	Labor Relations in the Public Sector	
LHR 458Y	History of Work in America	
LHR 437	Workplace Dispute Resolution	
Culminating Experience		
LGWR 894	Capstone Experience	3
Total Credits		30

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's

website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Labor and Global Workers' Rights (LGWR) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/lgwr/>)

Learning Outcomes

1. **KNOW:** Students will have and be able to demonstrate the necessary advanced knowledge and competence in the fields to excel in careers related to labor and workers' rights.
2. **COMMUNICATE:** Students will be able to effectively communicate knowledge of current topics in the fields both verbally and in writing to excel in careers related to labor and workers' rights.
3. **THINK:** Students will be able to recognize and analyze practical, legal, and ethical challenges related to labor and workers' rights in the global workplace and society.
4. **PRACTICE:** Students will be able to respond appropriately to practical, legal, and ethical challenges in domestic and global workplaces and society using both theoretical and practical approaches of the field.
5. **APPLY/CREATE:** Students will be able to interact effectively with other organizational representatives in the private and public spheres in helping to develop and implement policies and strategies.

Contact

Campus	University Park
Graduate Program Head	Elaine Hui
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Elaine Hui
Program Contact	Erin Hetzel 506 Keller Building University Park PA 16802 eab27@psu.edu (814) 867-4167
Program Website	View (https://ler.la.psu.edu/graduate/mps-in-labor-and-global-workers-rights/)

Laboratory Animal Medicine

Graduate Program Head	Ronald P. Wilson
Program Code	LAM
Campus(es)	Hershey (M.S.)
Degrees Conferred	Master of Science (M.S.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=LAM)

All students entering the program must have completed a professional degree program in veterinary medicine and must hold the degree of D.V.M., V.M.D., or equivalent. This program is only offered at the Penn State College of Medicine, Milton S. Hershey Medical Center.

The Department of Comparative Medicine is a basic science, academic department of the College of Medicine. It is concerned with the range of variation of normal and abnormal structure, function, and behavior in a variety of species of animals used for teaching, testing, and research. Its faculty, staff, and students work in a multidisciplinary and collaborative fashion with all other departments in the college to advance the research mission.

Graduate study in laboratory animal medicine consists of advanced training in biology, medicine and methodology pertinent to animal-based research, and the development of scholarship and research capabilities within the specialty. The general plan is one that provides a broad, basic foundation upon which the individual can build a career in teaching and research and/or in the professional direction of research animal facilities.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

To earn the master's degree, each student must complete at least 30 credits of course work at the 500 or 600 levels.

The curriculum of this training program includes:

Code	Title	Credits
Required Courses		
CMED 501	Biology and Care of Laboratory Animals	3
CMED 503	Laboratory Animal Genetics	3
CMED 507	Techniques of Laboratory Animal Experimentation	3
CMED 515	Experimental Surgery of Laboratory Animals	3
CMED 530	Diseases of Laboratory Animals I	3
CMED 531	Diseases of Laboratory Animals II	3
CMED 535	Comparative Pathology	3
CMED 590	(1 credit per semester)	4
CMED 596	Individual Studies	1-3
BMS 591	Biomedical Research Ethics	1
Culminating Experience		
Students completing a thesis enroll in CMED 600; students in the non-thesis option enroll in CMED 596. ¹		
CMED 600 or CMED 596	Thesis Research (for M.S. thesis) ² Individual Studies	9
Total Credits		36-38

¹ A non-thesis option may be elected by the student but must be approved in writing by the Program Director. A scholarly paper on a

topic relevant to the fields of laboratory animal medicine or laboratory animal science must be written and presented. Up to 9 credits of independent study (CMED 596) may be earned for this work.

² The submission and defense of a thesis based on an original hypothesis-driven research project is required. A minimum of 9 credits of thesis research (CMED 600) are required (a maximum of 6 credits may receive a quality grade).

Students may, with the approval of the Program Director, enroll in graduate level courses offered at the Penn State College of Medicine, Penn State Harrisburg, University Park, or Penn State's World Campus.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Comparative Medicine (CMED) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/cmcd/>)

Learning Outcomes

1. **KNOW:** Demonstrate appropriate breadth and depth of knowledge of husbandry, veterinary care, pathology, and colony management of species of animals commonly used in biomedical research.

2. **APPLY/CREATE:** Apply knowledge of laws, regulations, guidelines, and position statements concerning the use of animals in biomedical research to common research activities and scenarios.
3. **APPLY/CREATE:** Apply knowledge of anesthesia and analgesia of animal species used in biomedical research to critical evaluation of IACUC protocols, development of recommendations for prevention of pain and distress, and veterinary medical management of surgical procedures.
4. **APPLY/CREATE:** Apply knowledge of adult learning theory and education methodology to the design and execution of techniques training for researchers and other teaching activities.
5. **APPLY/CREATE:** Apply knowledge of research ethics, experimental design, techniques, data management, and data analysis to create new knowledge connected to the field of laboratory animal science and/or other biomedical science disciplines.
6. **COMMUNICATE:** Demonstrate a variety of methods for communicating scientific information, including formal presentations, discussion facilitation, written abstracts, written manuscripts, and poster presentations.
7. **THINK:** Critically evaluate published research in the field of laboratory animal science and biomedical research disciplines in order to practice evidence-based laboratory animal medicine, support animal welfare, and support the research mission.
8. **PROFESSIONAL PRACTICE:** Practice veterinary medicine in accordance with the highest ethical standards, values, and best practices for the recognized veterinary specialty of laboratory animal medicine.

Contact

Campus	Hershey Med Ctr
Graduate Program Head	Ronald Paul Wilson
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Tiffany Lynn Whitcomb
Program Contact	Mandy Houser College of Medicine, Dept of Comparative Medicine, H054 500 University Drive Hershey PA 17033 mlh36@psu.edu
Program Website	View (http://med.psu.edu/laboratory-animal-medicine-ms/)

Landscape Architecture

Graduate Program Head	Roxi Thoren
Program Code	LARCH
Campus(es)	University Park (M.L.A., M.S.)
Degrees Conferred	Master of Science (M.S.) Master of Landscape Architecture (M.L.A.) Dual-Title M.S. in Landscape Architecture and Transdisciplinary Research on Environment and Society Integrated B.L.A. in Landscape Architecture and M.S. in Landscape Architecture
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=LARCH)

Landscape Architecture is the art of design, planning, or management of the land and of the natural and built elements upon it. As an academic discipline, it embodies creative, cultural, philosophical, and scientific knowledge bases. As a professional endeavor, the practice of landscape architecture includes site design, urban design, master planning, community planning, regional planning, resource conservation, and environmental and social stewardship.

Master of Landscape Architecture (M.L.A.)

The M.L.A. program is an accredited professional degree program focused on preparation to practice Landscape Architecture for students who hold a bachelor's degree in another field. The Master of Landscape Architecture program prepares students to enter the profession of Landscape Architecture. It provides individuals who do not already have a practice-oriented design degree with a professionally accredited education in landscape architecture. The program prepares graduates for entry into professional offices or further study in Landscape Architecture or related disciplines.

M.S. in Landscape Architecture

The Master of Science in Landscape Architecture is a 2-year program that provides enhanced professional/scientific expertise to individuals who hold a professionally-accredited degree in Landscape Architecture or in Architecture. It's a great opportunity for those who seek to gain research skills, whether for professional practice or as preparation for success in academic positions.

This research-focused degree lets you work with outstanding faculty across Penn State on a targeted research agenda that may range from Landscape Performance Assessment to Built Environment and Active Living to Integrative Conservation—you and your adviser craft a tailored curricular path to suit your goals.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

To be admitted to the program, applicants must meet the following requirements:

- For admission to the M.L.A. program, applicants must have completed a bachelor's degree from any discipline prior to entry into the M.L.A. program.
- For admission to the M.S. in Landscape Architecture, applicants must have completed a bachelor's degree in Landscape Architecture or a closely related discipline.

All submissions for admission must include:

- Evidence of creativity (portfolio or other), evidence of analytical ability (research paper or other), and an essay explaining why the individual seeks to study landscape architecture at Penn State
- Official transcripts from all post-secondary institutions attended (<http://gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>).
- GRE scores
- 3 letters of recommendation

Scores from the Graduate Record Examinations (GRE), or from a comparable substitute examination, are required for admission.

Students with a 3.00 junior/senior average (on a 4.00 scale) will be considered for admission. The best-qualified applicants will be accepted up to the number of spaces available for new students. Exceptions to the minimum 3.00 grade-point average may be made for students with special backgrounds, abilities, and interests, at the discretion of the program.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of Landscape Architecture (M.L.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The M.L.A. curriculum develops creative insight and the knowledge, skills, and abilities essential to professional practice, fulfilling the education requirement needed in all states to be eligible to take the Landscape Architecture licensing examination. Students in the M.L.A. degree program must also develop research understanding characteristic of graduate education, undertaking a research-based design project as a final cumulative experience to demonstrate their understanding and application of appropriate and professional research and design expertise.

The M.L.A. curriculum requires completion of 57 credits of graduate work at the 400, 500, or 800 level, including a minimum of 47 credits at the 500 or 800 level, with at least 6 credits at the 500 level. In addition, to fulfill the requirements of professional accreditation, students must undertake 15 credits of prerequisite courses that do not count towards the M.L.A. degree requirements.

Code	Title	Credits
Requirements for Professional Accreditation (Prerequisites):		
LARCH 60	Cultural History of Designed Places	3
LARCH 145	Ecology and Plants I	3
LARCH 276	Human Dimensions of Design: History & Theory	3
LARCH 365W	Contemporary Trends in Landscape Architecture	3
LARCH 386	Professional Practice	3
Total Credits		15

Code	Title	Credits
Required Courses		
LARCH 414	Design and Theory V: Advanced Landscape Architectural Design	10
LARCH 815	Grad Studio I	6
LARCH 816	Grad Studio II	6
LARCH 817	Grad Studio III	6
LARCH 835	Grad Implementation I: Grading	3
LARCH 836	Grad Implementation II: Materials	3
LARCH 837	Grad Implementation III: Plants	3
LARCH 838	Grad Implementation IV: Stormwater	3
LARCH 501	Research and Writing in Landscape Architecture	3
LARCH 502	Intellectual History and Theory of Landscape Architecture	3
LARCH 510	Graduate Seminar in Landscape Architecture	3
LARCH 590	Colloquium	1
Culminating Experience		
LARCH 551	Final Culminating Experience Proposal ¹	1
LARCH 552	Final Culminating Experience Production ¹	4
LARCH 553	Final Culminating Experience Documentation & Presentation ¹	2
Total Credits		57

¹ The final culminating experience for the M.L.A. is a capstone project completed while enrolled in LARCH 551, LARCH 552, and LARCH 553.

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The core curriculum is a two-year research-focused program requiring a minimum of 40 credits including a minimum of 18 credits at the 500 or 600 level. Students are required to take graduate level coursework, including 12 credits of Graduate Seminar, 4 credits of Graduate Colloquium, 3 credits of Research Writing in Landscape Architecture, 3 credits in Intellectual History and Theory of Landscape Architecture, 3 credits in quantitative/qualitative analysis at the 500 level (which must be approved in advance by the student's adviser and/or the graduate program professor-in-charge), and at least 6 credits in thesis research (600 and 610). The student and the student's adviser, subject to the approval of the departmental Graduate Program Committee, determine specific course requirements. The thesis must be accepted by the adviser(s) and/or committee members, the head of the graduate program, and the Graduate School, and the student must pass a thesis defense.

Code	Title	Credits
Required Courses		
A 500-level course in quantitative/qualitative analysis		3
LARCH 501	Research and Writing in Landscape Architecture	3
LARCH 502	Intellectual History and Theory of Landscape Architecture	3
LARCH 510	Graduate Seminar in Landscape Architecture	12
LARCH 590	Colloquium	4
Electives		
The remaining elective credits may be chosen from a list of approved electives maintained by the program office.		9
Culminating Experience		
LARCH 600	Thesis Research (On Campus)	6
Total Credits		40

Dual-Titles

Dual-Title M.S. in Landscape Architecture and TRANSDISCIPLINARY RESEARCH ON ENVIRONMENT AND SOCIETY

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Graduate students with research and educational interests in landscape architecture or a closely related discipline (e.g., architecture, geography, ecology, anthropology, etc.) may apply to the dual-title M.S. degree in Landscape Architecture and Transdisciplinary Research on Environment and Society Program. The goal of the dual-title M.S. degree Landscape Architecture Transdisciplinary Research on Environment and Society is to enable graduate students from Landscape Architecture to acquire the knowledge and skills of their major area of specialization in Landscape Architecture, while at the same time gaining the perspective and methods of Transdisciplinary Research on Environment and Society.

Admission Requirements

Students must apply and be admitted to the graduate program in Landscape Architecture and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the TREES dual-title program. Refer to the Admission Requirements section of the TREES Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/transdisciplinary-research-environment-society/>). Doctoral students should enroll in a dual-title graduate degree program early in their training, and no later than the end of the fourth semester (not counting summer semesters) of entry into the graduate major program.

Degree Requirements

To qualify for this dual-title degree, students must satisfy the requirements of the Landscape Architecture Master of Science degree program, listed on the Degree Requirements tab. In addition, they must satisfy the TREES program requirements for the dual-title master's degree. Refer to the Master's Degree Requirements section of the TREES Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/transdisciplinary-research-environment-society/>). Some courses may satisfy both the graduate primary program requirements and those of the TREES program. Final course selection, including which courses will satisfy the both the graduate major program and dual-title program

requirements, is determined by the students with approval by their dual-title program advisers and their major program advisers.

For the dual-title M.S. degree in Landscape Architecture and TREES, the thesis must reflect the student's education and interest in both Landscape Architecture and TREES. All members of the student's committee must be members of the Graduate Faculty. The master's committee must include at least one Graduate Faculty member from TREES. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role.

Integrated Undergrad-Grad Programs

Integrated B.L.A. in Landscape Architecture and M.S. in Landscape Architecture

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.L.A. in Landscape Architecture with the M.S. in Landscape Architecture offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- University Park

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The integrated undergraduate-graduate (IUG) degree program (B.L.A. in Landscape Architecture/M.S. in Landscape Architecture) provides an opportunity for strong students in Penn State's Landscape Architecture B.L.A. program to complete a master's degree with 6 total years of study (the B.L.A. is a 5-year program).

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The number of openings in the integrated B.L.A. /M.S. program is limited. Admission is selective based on specific criteria set by the Department of Landscape Architecture (see below). Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.

Admission Requirements:

1. Must be enrolled in the Landscape Architecture B.L.A. program.
2. Must apply to, and be accepted into, The Graduate School and the M.S. program in Landscape Architecture. Students must complete the Graduate School application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>).

3. All applicants will submit GRE scores, three letters of recommendation, and a personal statement addressing their reasons for pursuing a graduate degree in Landscape Architecture and discussing their plans and goals.
4. An applicant will be expected to have a minimum overall GPA of 3.5 (on a 4.0 scale) in undergraduate coursework and a minimum GPA of 3.5 in all coursework completed for the major.
5. A plan of study must be included identifying undergraduate credits to be applied to the M.S. degree elective requirements.

In consultation with both the Undergraduate Academic Advisor in the Stuckeman School and the Graduate Coordinator in Landscape Architecture, the applicant should prepare a plan of study that covers the entire time period of the IUG program. The plan should be reviewed periodically with both the Undergraduate Academic Advisor in the Stuckeman School and the Graduate Coordinator in Landscape Architecture.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.S. in Landscape Architecture are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.S. degree are listed on the Degree Requirements tab. The program will accept 5 credits of LARCH 414 from students in the IUG program, in lieu of 3 credits of LARCH 510 and 3 credits of LARCH 590. Students in the IUG program must also take an additional 1 credit elective to meet the 40 credit minimum required for the degree.

Up to 14 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
LARCH 414	Design and Theory V: Advanced Landscape Architectural Design	5
LARCH 501	Research and Writing in Landscape Architecture	3
Select electives from the following list:		
ANTH 559	Human Ecology	
ECLGY 510	Classical Ecology	
FOR 565	GIS Based Socio-Ecological Landscape Analysis	
GEODZ 511	Geodesign History, Theory, Principles	
GEOG 550	Wetlands Ecology and Management	
TREES 574	Integrated Perspectives in Transdisciplinary Research on Environment and Society	
TREES 575	Ethical Issues in Transdisciplinary Research on Environment and Society	
RSOC 555	Human Dimensions of Natural Resources	

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next

appropriate Commencement. If students accepted into the IUG program are unable to complete the M.A. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Landscape Architecture (LARCH) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/larch/>)

Professional Licensure/Certification

Many U.S. states and territories require professional licensure/certification to be employed. If you plan to pursue employment in a licensed profession after completing this program, please visit the Professional Licensure/Certification Disclosures by State (<https://www.psu.edu/state-licensure-disclosures/>) interactive map.

Contact

Campus	University Park
Graduate Program Head	Roxi Thoren
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Stuart Patton Echols
Program Contact	Nina Diez Bumgarner 121 Stuckeman Family Building University Park PA 16802 ndb2@psu.edu (814) 865-0991
Program Website	View (https://stuckeman.psu.edu/larch/)

Language Science

Graduate Program Head	Michael Travis Putnam
Program Code	LANGSC
Campus(es)	University Park
Degrees Conferred	Dual-Title
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=LANGSC)

Students electing this degree program through participating programs earn a degree with a dual-title at the Ph.D. level, i.e., Ph.D. in (graduate program name) and Language Science.

The following graduate programs offer dual-title Ph.D. degrees in Language Science:

- Communication Sciences and Disorders
- German
- Psychology
- Spanish

A dual-title degree program in participating programs and Language Science will prepare students to combine the theoretical and methodological approaches of several disciplines in order to contribute to research in the rapidly growing area of Language Science. This inherently interdisciplinary field draws on linguistics, psychology, speech-language pathology, and cognitive neuroscience, as well as other disciplines, to address both basic and applied research questions in such areas as first and second language acquisition, developmental and acquired language disorders, literacy, and language pedagogy. Dual-title degree students will receive interdisciplinary training that will enable them to communicate and collaborate productively with a wide range of colleagues across traditional discipline boundaries. Such training will open up new employment opportunities for students and give them the tools to foster a thriving interdisciplinary culture in their own future students. The dual-title program will facilitate the formation of a cross-disciplinary network of peers for participating students as part of their professional development.

Admission Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

To pursue a dual-title degree under this program, the student must first apply to the Graduate School and be admitted through one of the participating graduate degree programs. Upon admission to one of those programs and with a recommendation from a Language Science program faculty member in that department, the student's application will be forwarded to a committee that will include the Director of the Linguistics Program, one of the Co-Directors of the Center for Language Science, and a third elected faculty member within the Center for Language Science. All three committee members will be affiliated with the Program in Linguistics. Upon the recommendation of this committee, the student will be admitted to the dual-title degree program in Language Science. Doctoral students must be admitted into the dual-title degree program in Language Science prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

The dual-title Ph.D. degree in Language Science will have the following requirements.

Course work (21 credits of 500-level courses):

Code	Title	Credits
Required Courses		
LNGSC 521	Proseminar in the Language Science of Bilingualism	3
LNGSC 522	Proseminar in Professional Issues in Language Science	3
LING 500 or LING 504	Syntax II Phonology II	3
3 credits,	Research methods/statistics in Language Science (such as LING 525, PSY 507, PSY 508)	3
3 credits,	Cognitive Neuroscience or Psycholinguistics (such as PSY 520/LING 520, PSY 511)	3
6 credits,	Research internships (students will choose one course among the following: CSD 596, GER 596, LING 596, PSY 596, SPAN 596)	6
Total Credits		21

Where these courses also satisfy requirements in the major program, they may be counted as satisfying the requirements of both programs (subject to any limits imposed by the major program), because the requirements of the dual-title degree ensure that students' training will meet the cross-disciplinary goals of the dual-title.

Language Science Research Meetings

Students must participate in weekly Language Science Research meetings each semester in residence.

Foreign Language and English Competency Requirements

The student will fulfill the language requirement specified by the participating department through which the student is admitted to the dual-title degree program.

Qualifying Examination

Students will take a qualifying examination that is administered by the primary program. However, the dual-title degree student may require

an additional semester or more to fulfill requirements for the primary program and dual-title program, and the qualifying exam integrates material from both the primary and the dual-title fields (minimally, through the portfolio described in this paragraph); therefore, the qualifying examination may be delayed one semester beyond the normal period allowable. In addition, the student will be required to present a portfolio of work in Language Science to their committee. Such a portfolio would include a statement of the student's interdisciplinary research interests, a plan of future study, and samples of writing that indicate the student's work in Language Science. The qualifying examination committee will be composed of faculty from the primary program, as well as at least one faculty member affiliated with Language Science. The designated Language Science faculty member may be appointed in the student's primary program, but he or she may also hold a formal appointment with Linguistics. The Language Science member will participate in constructing and grading qualifying examination questions in the area of Language Science.

Ph.D. committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Language Science dual-title Ph.D. student will include a representative of the Language Science dual-title program. The student's Ph.D. committee will include faculty from the primary program as well as faculty from Language Science. Faculty members who hold appointments in both the primary program and Language Science may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Language Science, the member of the committee representing Language Science must be appointed as co-chair.

Comprehensive Examination

The Language Science representative(s) will help to insure that the field of Language Science is integrated into the comprehensive examination.

Dissertation

A dissertation on a topic related to Language Science is required for a dual-title Ph.D. degree in Language Science. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

Requirements listed here are in addition to requirements for minors in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Most students will be funded through their primary departments, and will be considered for graduate assistantships according to the procedures

of those departments. The Center for Language Science currently has two graduate assistantships for which dual-title degree students will be eligible.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Linguistics (LING) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/ling/>)

Learning Outcomes

1. **KNOW:** Develop in-depth scholarly knowledge across multiple disciplines of Language Science.
2. **THINK:** Demonstrate analytical and critical thinking by exploring the different perspectives or interpretations that are offered by different disciplines in Language Science to approach related issues or questions.
3. **APPLY/CREATE:** Select from and apply techniques from multiple disciplines, as appropriate, for the creation of new knowledge.
4. **COMMUNICATE:** Present research to audiences from multiple disciplinary backgrounds, explain the relevance of their research to different disciplines, and field questions.
5. **PROFESSIONAL PRACTICE:** Know, practice, and uphold standards of academic, professional, and ethical integrity as appropriate to the various disciplines in Language Science.

Contact

Campus	University Park
Graduate Program Head	Michael Travis Putnam
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Michael Travis Putnam
Program Contact	Heather Rutten 442 Burrowes Bldg. University Park PA 16802 hxr87@psu.edu (814) 863-0997

Leadership Development

Graduate Program Head	Zugang Liu
Program Code	LEAD
Campus(es)	Great Valley (M.L.D.)
Degrees Conferred	Master of Leadership Development (M.L.D.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=LEAD)

The Master of Leadership Development program at Penn State Great Valley helps students to foster positive change and develop leadership potential in themselves and others.

The program explores leadership across the lifespan, from early career through retirement, including leadership in the corporate and not-for-profit realms, as well as parenting and community service. We employ a multidisciplinary approach stressing social responsibility and ethics, creativity and innovation, diversity and global mindset, dynamic communication and visioning, and most importantly, the value of the individual. The program is fully accredited by AACSB International.

The program's goal is to put students on the path to the C-suite – where strategic leadership skills are used to build human, social, reputational, and financial capital. The cornerstones of the program focus on self and authentic leadership, transformational and transactional leadership, and critical thinking and data analysis which prepare students for this journey.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Admission is granted only to candidates who demonstrate high promise of success for graduate work.

An undergraduate and/or graduate GPA of at least 3.0 on a 4.0 scale is required for admission. It is strongly preferred that applicants present at least five years of related professional work experience.

Admission decisions are based on a review of the applicant's professional and academic accomplishments as presented in the Admissions Dossier and the quality of the applicant's credentials in relation to those of other applicants who meet the requirements for admission. A complete Admissions Dossier includes the following:

- online Graduate School application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) and non-refundable application fee;
- current resume, preferably indicating at least five years of related work experience;
- official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>);
- completion of two 300-word leadership essay questions developed by the faculty to assess an applicant's logical reasoning and writing skills;
- two confidential evaluation forms/letters of endorsement from executives or community leaders detailing their evaluation of the applicant's leadership ability and potential.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of Leadership Development (M.L.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

A minimum of 36 credits at the 400, 500, or 800 level is required, with a minimum of 18 credits at the 500 or 800 level, and at least 6 credits at the 500 level. A series of leadership cornerstone (9 credits) and leadership competency courses (12 credits) are required to provide all MLD students with a common body of knowledge. Leadership Context courses (12 credits) and a Capstone course (3 credits) round out the program.

Code	Title	Credits
Required Courses		
Leadership Cornerstone courses (9 credits) provide a foundation for leadership development studies. They include:		
LEAD 501	Leadership Across the Lifespan	3
BUSAD/LEAD 555	Full Range Leadership Development	3
LEAD 557	Leadership Models and Methods	3
Leadership Competency courses (12 credits) build a foundation for effective leadership communication, creativity/innovation, and moral development. They include:		
LEAD 561	Dynamic Communication in Leadership Contexts	3
BUSAD/LEAD 556	Diversity Leadership	3
or BUSAD 542	Global Intercultural Management	
One of the following:		3
MGMT 873	Corporate Innovation Strategies	
SYSEN 550		
BUSAD/LEAD 519	Developing Creative High Performance Organizations	
One of the following:		3
MBADM 815	Ethical and Responsible Business Leadership	
LEAD 863	Ethical Dimensions of Leadership	
PSY 833	Ethics and Leadership: Psychological and Social Processes	
STS 589	Ethics and Values in Science and Technology	
Leadership Context courses (12 credits) provide an overview of the situations in which leadership processes are embedded. Students can choose 4 context-specific electives (12 credits). A list of courses that will fulfill this requirement is maintained by the program office.		12
Culminating Experience		
All students must complete a capstone course that provides students with an opportunity to enact what they have learned in their course work in the context of promoting positive change in their organizations:		
LEAD 862	Strategic Leadership (Capstone Course)	3
Total Credits		36

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)

- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Refer to the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students in this program are not eligible for graduate assistantships.

Financial aid for students in on-campus programs is in the form of student loans and a limited number of small scholarships, as described on the Penn State Great Valley website (<https://greatvalley.psu.edu/tuition-and-financial-aid/>).

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Leadership Development (LEAD) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/lead/>)

Learning Outcomes

Learning Goal 1: Build one's own personal authentic transformational leadership competencies through self-reflection and behavioral display.

- Develop and implement a personal diversity leadership improvement plan to build expertise in relating with diverse individuals in the workplace.
- Prepare a personal leadership development plan incorporating feedback from others, and personal strengths and weaknesses with respect to specific leadership behaviors.

Learning Goal 2: Build communication and critical thinking skills as they relate to authentic transformational leadership concepts and processes.

- Write three short essays applying communication theory to specific leadership contexts, situations, and opportunities.
- Demonstrate skills required for conducting research in organizations.

Learning Goal 3: Foster a commitment to high integrity practices.

- Evaluate and analyze the ethical dimension of decision making.

Learning Goal 4: Value differences in people as a vital force in work groups, teams and organizations.

- Develop and implement a personal diversity leadership improvement plan to build expertise in relating with diverse individuals in the workplace.

- Discuss how concepts of transformational leadership and authentic leadership relate to social entrepreneurship, and add value to personal relationships, community, and society at large.

Contact

Campus	Great Valley
Graduate Program Head	Zugang Liu
Program Contact	DENISE Y. SMITH Penn State Great Valley 30 E. Swedesford Road Malvern PA 19355 dms7338@psu.edu (610) 648-3336
Program Website	View (http://greatvalley.psu.edu/academics/masters-degrees/leadership-development/)

Learning, Design, and Technology

Graduate Program Head	Susan Land
Program Code	LDT
Campus(es)	University Park (Ph.D., M.S., M.Ed.) World Campus (M.Ed.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Master of Education (M.Ed.) Dual-Title Ph.D., M.S., and M.Ed. in Learning, Design, and Technology and Comparative and International Education
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=LDT)

This program provides advanced professional preparation in the development of effective, efficient instructional materials and the use of technology to support learning in a variety of educational settings. The program of study applies skill and knowledge from the fields of the learning sciences, instructional design, computer technologies, and research methodologies to study educational designs and their effect on learning. Graduates are employed as instructional designers by corporate, agency, and military training departments; entrepreneurial consulting companies; public school districts; museums, nature centers, and other informal learning settings; community college learning resource centers; and colleges and universities.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>), letters of reference, application letter, and writing assignment are required for admission (for master's or doctorate degrees). Doctoral applicants may be asked

to submit an additional writing assignment. GRE scores will not be accepted.

Degree Requirements

Master of Education (M.Ed.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

At least 18 credits must be taken at the 500 level or above, with at least 6 credits at the 500 level. Students in the M.Ed. program are required to complete a program of a minimum of 30 approved credits including:

Code	Title	Credits
Required Courses		
LDT 415A	Systematic Instructional Development	3
or LDT 415B	Systematic Instructional Development for Teachers	
LDT 467	Emerging Web Technologies and Learning	3
LDT 527	(or equivalent)	3
21 credits of professional application courses chosen in consultation with an adviser. These courses can be chosen from, but are not limited to:		
LDT 401	Gaming to Learn	
LDT 433	Teaching and Learning Online in K-12 Settings	
LDT 440	Educational Technology Integration	
LDT 449	Video in the Classroom	
LDT 505	Integrating Mobile Technologies into Learning Environments	
LDT 550	Learning Design Studio	
LDT 566	Computers as Learning Tools	
LDT 581	Theoretical Foundations of Learning, Design, and Technology	
LDT 832	Designing e-learning Within Course Management Systems	

Culminating Experience

All students will compile a portfolio as they move through the courses, and this portfolio will be presented to the adviser as the capstone experience (students do not need to enroll in any additional courses to complete the capstone experience).

Total Credits **30**

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

At least 18 credits must be taken at the 500 level or above, with at least 6 credits at the 500 level. Students in the M.S. degree program are required to complete a minimum of 36 approved credits including:

Code	Title	Credits
Required Courses		
LDT 415A	Systematic Instructional Development	3
or LDT 415B	Systematic Instructional Development for Teachers	
LDT 467	Emerging Web Technologies and Learning	3
LDT 527	(or equivalent)	3

12 credits chosen in consultation with an adviser. These courses can be chosen from, but are not limited to:

LDT 401	Gaming to Learn	
LDT 433	Teaching and Learning Online in K-12 Settings	
LDT 440	Educational Technology Integration	
LDT 449	Video in the Classroom	
LDT 505	Integrating Mobile Technologies into Learning Environments	
LDT 550	Learning Design Studio	
LDT 566	Computers as Learning Tools	
LDT 581	Theoretical Foundations of Learning, Design, and Technology	
LDT 832	Designing e-learning Within Course Management Systems	

Research Methods Courses

6 credits of research methods courses with adviser approval, which can include, but are not limited to:

STAT 500	Applied Statistics	
STAT 800	Applied Research Methods	
ADTED 550	Qualitative Research in Adult Education	
LDT 574	Applied Qualitative Research for Work Practice, Innovation, and Systems Design	
LDT 575	Designing Experimental Research in Learning, Design, and Technology	
LDT 576	Design-based Research Methods, Applications for Educational Research	
EDPSY 406	Applied Statistical Inference for the Behavioral Sciences	
EDPSY 575	Seminar in Educational Psychology	
EDPSY 505	Statistical Applications in Educational Research	

Culminating Experience

LDT 594	Research Topics (to conduct their research project)	3
LDT 600/610	Thesis Research (to write and produce a master's thesis)	6

Total Credits **36**

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Credit and course requirements: Ph.D. students in LDT must complete a set of core competencies in instructional design, learning sciences and technology, research methodology, and research apprenticeship. Doctoral students must complete a minimum of 30 LDT credits to include 9 credits of LDT doctoral core courses, 9 credits of LDT 594, and at least 12 credits of 500-level graduate LDT courses based on competency selection.

Code	Title	Credits
Required Courses		
<i>LDT Doctoral Core Courses</i>		
LDT 527		3
LDT 581	Theoretical Foundations of Learning, Design, and Technology	3

LDT 583	Survey of Research in Learning Sciences and Technology	3
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Core Competency Courses

Core competencies are represented by a number of courses including 12 (but not limited to):¹

LDT 505	Integrating Mobile Technologies into Learning Environments	
LDT 550	Learning Design Studio	
LDT 586	Diffusion and Adoption of Innovations and Change	
LDT 544	Video for Instruction, Training, and Research	
LDT 549	Current Topics in Emerging Technologies	
LDT 574	Applied Qualitative Research for Work Practice, Innovation, and Systems Design	
LDT 575	Designing Experimental Research in Learning, Design, and Technology	
LDT 576	Design-based Research Methods, Applications for Educational Research	
LDT 832	Designing e-learning Within Course Management Systems	

Research Courses

LDT 594	Research Topics	9
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Total Credits **30**

¹ As an example, a doctoral student interested in the instructional design core competency might be advised to take LDT 550, LDT 549, and LDT 832, while a student interested in learning sciences and technology might be advised into LDT 505, LDT 574, LDT 576, and LDT 544. The 12 credits of core competencies plus additional course work for the doctoral program will be determined in consultation with the Ph.D. committee.

All Ph.D. students must also complete a communication requirement consisting of one course in applied statistics, and either one course in advanced statistics or one course in advanced qualitative analysis. Course work offered by outside departments may be scheduled as part of the student's program with approval of the student's Ph.D. committee and the Director of Graduate Studies.

To complete the residency requirements as defined by Graduate Council, the Ph.D. student must spend at least two consecutive semesters enrolled as a full-time student at the University Park campus.

Doctoral exams and committees

The qualifying exam is recommended to be taken early in a student's program, after a minimum of 18 credits of post-baccalaureate work, and within three semesters (not including summers and assuming full-time study) of entry into the doctoral program. Students must submit an application to take the qualifying exam, and the LDT faculty must approve the application. In order to complete the qualifying exam, students must be registered either full- or part-time during the semester in which it is completed and show no deferred or failing grades in courses related to the degree program on their graduate transcript.

Prior to the comprehensive exam, the student, in consultation with his or her adviser, will convene a Ph.D. committee that meets all Graduate Council requirements (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>). After the completion of all course work, the doctoral student must complete a comprehensive examination. All doctoral candidates must produce and

write a doctoral dissertation and hold a final oral examination in defense of the dissertation.

Dual-Titles

Dual-Title M.Ed., M.S., and Ph.D. in Learning, Design, and Technology and Comparative and International Education

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Students must apply and be admitted to the graduate program in Learning, Design, and Technology and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Comparative and International Education dual-title program. Refer to the Admission Requirements section of the Comparative and International Education Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/comparative-international-education/>). Doctoral students must be admitted into the dual-title degree program in Comparative and International Education prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Learning, Design, and Technology. In addition, students must complete the degree requirements for the dual-title in Comparative and International Education, listed on the Comparative and International Education Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/comparative-international-education/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Learning, Design, and Technology and must include at least one Graduate Faculty member from the Comparative and International Education program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Learning, Design, and Technology and Comparative and International Education. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Learning, Design, and Technology and Comparative and International Education dual-title Ph.D. student must include at least one member of the Comparative and International Education Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Comparative and International Education, the member of the committee representing Comparative and International Education must be appointed as co-chair. The Comparative and International Education representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Learning, Design, and Technology and Comparative and International Education. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

A limited number of graduate assistantships are available to students in this program.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Design and Technology (LDT) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/ldt/>)

Learning Outcomes

Master's Degrees

1. Know/Think: Graduates will demonstrate practical knowledge of the core theories and best practices in the field of learning, design, & technology (LDT).

2. Apply/Create: Graduates will be able to design and develop educational resources in accordance with the core theories and best practices in LDT.
3. Apply/Create: Graduates will demonstrate the ability to analyze and integrate teaching/learning technologies to unique educational contexts in accordance with the core theories and best practices in LDT.
4. Communicate/Think: Graduates will be able to convey ideas or arguments in clear, concise, well-organized papers, proposals, and portfolios as well as in formal, oral presentations.
5. Professional practice: Graduates will demonstrate knowledge of the professional standards, and values, integrity, and ethics in the LDT field and at Penn State through written or oral products, and professional interactions with colleagues.

Doctor of Philosophy (Ph.D.)

1. Know/Think: Graduates will demonstrate in-depth knowledge of the core theories and research methods in the field of learning, design, & technology (LDT). The core demonstration will include the comprehension of theories of learning sciences and LDT to conceptualize problems of educational practice.
2. Apply/Create: Graduates will be able to formulate and execute an independent research project that significantly furthers knowledge and theories in LDT.
3. Apply/Create: Graduates will demonstrate the ability to apply theories to inform/develop unique designs and solutions to educational problems.
4. Communicate/Think: Graduates will be able to convey ideas or arguments in clear, concise, well-organized papers and proposals as well as in formal, oral presentations.
5. Professional practice: Graduates will demonstrate knowledge of the professional standards, and values, integrity, and ethics in the field and at Penn State through written and oral products, and professional interactions with colleagues.

Contact

Campus	University Park
Graduate Program Head	Susan Land
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Heather Toomey Zimmerman
Program Contact	Darlene G Glab 301 Keller University Park PA 16802 dgg11@psu.edu (814) 863-9768
Program Website	View (http://ed.psu.edu/lps/ldt/)

Campus	World Campus
Graduate Program Head	Susan Land
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Heather Toomey Zimmerman
Program Contact	Darlene G Glab 303 Keller Building University Park PA 16802 dgg11@psu.edu (814) 863-9768
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/instructional-systems-educational-technology-masters/overview/)

Lifelong Learning and Adult Education

Graduate Program Head	Susan Land
Program Code	LLAED
Campus(es)	University Park (Ph.D., D.Ed., M.Ed.) World Campus (M.Ed.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Doctor of Education (D.Ed.) Master of Education (M.Ed.) Dual-Title Ph.D., D.Ed., and M.Ed. in Lifelong Learning and Adult Education and Comparative and International Education Joint M.D. / M.Ed. with the College of Medicine
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=LLAED)

Lifelong Learning and Adult Education extends through the life span from late adolescence to advanced age and takes place in a rich diversity of organizational as well as informal settings. The Lifelong Learning and Adult Education degree can open doors worldwide to successful careers in faculty and administration positions at universities and colleges or to fulfilling leadership and research positions at government and public agencies non-governmental organizations, churches or religious organizations, adult basic education programs, healthcare providers, international organizations, and community-based organizations. Course work, reading assignments, research projects, internships, informal discussions, and the dissertation all provide opportunities for in-depth and challenging learning experiences. The Lifelong Learning and Adult Education program is interdisciplinary, and students are advised to take courses in supporting fields within the University.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The best-qualified applicants will be accepted up to the number of spaces that are available for new students. Applicants with a junior/

senior grade point average (GPA) of 3.00 or above (on a 4.00 scale), and a graduate GPA of 3.50 or above will be highly considered applications to the program. However, applicants with strong backgrounds and abilities in areas of particular interest or relevance to adult education practice may be admitted to either of the doctoral programs with a baccalaureate degree only (provided the junior/senior GPA is at least 3.0), or with master's-level studies in which the graduate GPA is at least 3.2. GRE scores are not required for admission.

A sample of student writing is required for each degree. M.Ed. applicants submit a recent writing sample, such as a term paper, report, or publication of 3000 words or more. Ph.D. and D.Ed. applicants should submit either a published article, master's paper, master's thesis, or a paper from their master's studies.

Three letters of reference are required from people who are best qualified to evaluate the applicant's ability to succeed in graduate study. These letters may be from an academic adviser, instructors who are familiar with the applicant's academic record, a research project supervisor, an employment supervisor, or others who are able to provide a substantive evaluation of the applicant's work. Letters of recommendation must address the applicant's academic ability, motivation, and likelihood of success in completing the program.

A statement of purpose describing the applicant's short and long range career objectives is required. This statement includes an explanation of how the proposed study of adult education relates to the stated career objectives.

Applicants who exhibit exceptional qualities without meeting all of the stated requirements for admission may be considered for provisional admission (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-303-provisional-admission/>) while they remove the identified deficiencies. Deficiencies must be rectified within the first two semesters of enrollment in the degree program; courses taken to remove deficiencies are considered to be prerequisites and do not earn credit toward the degree.

Degree Requirements

Master of Education (M.Ed.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

A minimum of 30 credits is required for the M.Ed. degree. A minimum of 18 credits out of the 30 must be taken at the 500- or 800-level, with a minimum of 6 credits at the 500-level, and a minimum of 24 credits must be in ADTED prefix courses. The M.Ed. program in Lifelong Learning and Adult Education consists of a required core of 12 credits in ADTED courses and 18 credits in ADTED or other electives.

Code	Title	Credits
Required Courses		
ADTED 460	Introduction to Lifelong Learning and Adult Education	3
ADTED 505	The Teaching of Adults	3
ADTED 542	Perspectives on Adult Learning Theory	3
Electives		
Select an additional 18 credits (six courses) from the following ADTED courses in consultation with your adviser. ¹		18
ADTED 456	Introduction to Family Literacy	

ADTED 457	Adult Literacy	
ADTED 470	Introduction to Distance Education	
ADTED 480	Teaching Math and Numeracy to Adults	
ADTED 501	Foundations of Medical Education	
ADTED 502	Program and Instructional Design in Medical Education	
ADTED 506	Program Planning in Adult Education	
ADTED 507	Research and Evaluation in Adult Education	
ADTED 509	Language, Literacy, Identity, and Culture in a Global Context	
ADTED 510	Historical and Social Issues in Adult Education	
ADTED 531	Course Design and Development in Distance Education	
ADTED 532	Research and Evaluation in Distance Education	
ADTED 533	Global Online and Distance Education	
ADTED 560	Teaching Reading to College Students and Adults	
ADTED 575	Administration of Adult Education	
ADTED 581	Social Theory and Lifelong Learning	
Culminating Experience		
ADTED 588	Professional Seminar: Research and Adult Education	3

Total Credits **30**

¹ Other courses may be substituted for these electives with the adviser's permission.

M.Ed. students are required to write a master's paper as part of the required 30 credits of course work. Students complete the master's paper while enrolled in ADTED 588 during their last semester.

M.Ed. students must select either the general M.Ed. degree or one of the three formal options:

1. Adult Basic Education and Literacy
2. Global and Online Distance Education
3. Medical and Health Professions

M.Ed. students who select a formal option must adhere to the requirements specified below.

Adult Basic Education and Literacy Option

The M.Ed. in Lifelong Learning and Adult Education – Adult Basic Education and Literacy Option consists of a required core of 12 credits in ADTED courses, 12 credits in ADTED courses required for this option, and 6 credits of ADTED or other electives.

Code	Title	Credits
Required Courses		
ADTED 460	Introduction to Lifelong Learning and Adult Education	3
ADTED 505	The Teaching of Adults	3
ADTED 542	Perspectives on Adult Learning Theory	3
Required Option Courses		
ADTED 480	Teaching Math and Numeracy to Adults	3
ADTED 507	Research and Evaluation in Adult Education	3
ADTED 509	Language, Literacy, Identity, and Culture in a Global Context	3

ADTED 560	Teaching Reading to College Students and Adults	3
Electives		
Select an additional 6 credits (two courses) of the following ADTED courses in consultation with your adviser. ¹		
ADTED 456	Introduction to Family Literacy	
ADTED 457	Adult Literacy	
ADTED 470	Introduction to Distance Education	
ADTED 506	Program Planning in Adult Education	
ADTED 510	Historical and Social Issues in Adult Education	
ADTED 531	Course Design and Development in Distance Education	
ADTED 533	Global Online and Distance Education	
ADTED 575	Administration of Adult Education	
ADTED 581	Social Theory and Lifelong Learning	
Culminating Experience		
ADTED 588	Professional Seminar: Research and Adult Education	3
Total Credits		30

¹ Other courses may be substituted for these electives with the adviser's permission.

Global Online and Distance Education Option

The M.Ed. in Lifelong Learning and Adult Education – Global Online and Distance Education Option consists of a required core of 12 credits in ADTED courses, 12 credits in ADTED courses required for this option, and 6 credits of ADTED or other electives.

Code	Title	Credits
Required Courses		
ADTED 460	Introduction to Lifelong Learning and Adult Education	3
ADTED 505	The Teaching of Adults	3
ADTED 542	Perspectives on Adult Learning Theory	3
Required Option Courses		
ADTED 470	Introduction to Distance Education	3
ADTED 531	Course Design and Development in Distance Education	3
ADTED 532	Research and Evaluation in Distance Education	3
ADTED 533	Global Online and Distance Education	3
Electives		
Select an additional 6 credits (two courses) from the following courses in consultation with your adviser. ¹		
ADTED 506	Program Planning in Adult Education	
ADTED 510	Historical and Social Issues in Adult Education	
ADTED 575	Administration of Adult Education	
ADTED 581	Social Theory and Lifelong Learning	
Culminating Experience		
ADTED 588	Professional Seminar: Research and Adult Education	3
Total Credits		30

¹ Other courses may be substituted for these electives with the adviser's permission.

Medical and Health Professions Option

The M.Ed. in Lifelong Learning and Adult Education – Medical and Health Professions Option consists of a required core of 12 credits in ADTED courses, 9 credits in ADTED courses required for this option, and 9 credits of ADTED or other electives.

Code	Title	Credits
Required Courses		
ADTED 460	Introduction to Lifelong Learning and Adult Education	3
ADTED 505	The Teaching of Adults	3
ADTED 542	Perspectives on Adult Learning Theory	3
Required Option Courses		
ADTED 501	Foundations of Medical Education	3
ADTED 502	Program and Instructional Design in Medical Education	3
ADTED 507	Research and Evaluation in Adult Education	3
Electives		
Select at least 3 additional credits (one course) from the following ADTED courses in consultation with your adviser. ¹		
ADTED 470	Introduction to Distance Education	
ADTED 510	Historical and Social Issues in Adult Education	
ADTED 531	Course Design and Development in Distance Education	
ADTED 533	Global Online and Distance Education	
ADTED 575	Administration of Adult Education	
ADTED 581	Social Theory and Lifelong Learning	
Select an additional 6 credits of electives in consultation with your adviser.		
Culminating Experience		
ADTED 588	Professional Seminar: Research and Adult Education	3
Total Credits		30

¹ Other courses may be substituted for these electives with the adviser's permission.

Doctor of Education (D.Ed.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

A minimum of 60 credits beyond the master's degree is required for the D.Ed. degree. A minimum of 90 credits is required for the D.Ed. degree, of which at least 30 must be earned in residence at either University Park. D.Ed. students who do not have previous experience in adult education are expected to acquire the equivalent of one year of experience in one or more fields of adult education practice prior to receiving their D.Ed. degree. All doctoral students must pass a qualifying examination, a comprehensive written and oral examination, and a final oral examination. To earn the D.Ed. degree, doctoral students must also write a dissertation that is accepted by the doctoral committee, the head of the graduate program, and the Graduate School.

The qualifying examination is administered after when the student has earned a total of at least 30 credits toward the graduate degree, including the master's program and graduate work done elsewhere. During the comprehensive examination, in addition to being examined in their area of

specialization, all D.Ed. students are examined in the core adult education areas. A minimum of 21 credits in course work must be taken in Lifelong Learning and Adult Education, including:

Code	Title	Credits
Required Courses		
ADTED 460	Introduction to Lifelong Learning and Adult Education	3
or ADTED 521	Doctoral Proseminar	
ADTED 510	Historical and Social Issues in Adult Education	3
ADTED 542	Perspectives on Adult Learning Theory	3
Electives		
12 credits of ADTED electives		12
A minimum of 15 credits must be taken outside Lifelong Learning and Adult Education as a minor or General Studies option.		15
A minimum of 9 credits must be taken in research methods courses, including:		9
one graduate-level basic statistics course		
ADTED 550	Qualitative Research in Adult Education	
one course on quantitative design/methods		
Culminating Experience		
ADTED 600	Thesis Research	15
or ADTED 610	Thesis Research Off Campus	
Total Credits		60

D.Ed. students conduct applied research with the goal of improving practice in the general adult education field.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A minimum of 48 credits beyond the master's degree is required for the Ph.D. degree. Ph.D. students are required to take:

Code	Title	Credits
Required Courses		
ADTED 521	Doctoral Proseminar	3
or ADTED 460	Introduction to Lifelong Learning and Adult Education	
ADTED 508	Globalization and Lifelong Learning	3
ADTED 510	Historical and Social Issues in Adult Education	3
ADTED 542	Perspectives on Adult Learning Theory	3
Emphasis Area		
18 credits in an emphasis area, including at least 6 credits of ADTED electives and at least 9 credits chosen from one or more Supporting Area(s) outside of Lifelong Learning and Adult Education. A list of courses that will count towards the Supporting Areas requirement is maintained by the graduate program office.		18
Research		
18 research credits, including:		18
one graduate-level basic statistics course		
ADTED 550	Qualitative Research in Adult Education	
one course on quantitative design/methods		
Total Credits		48

In addition, Ph.D. students must fulfill the residency requirement and English competence requirements, must pass qualifying, comprehensive, and final oral examinations, and maintain continuous registration during dissertation research.

Ph.D. students are required to take 12 core credits in Lifelong Learning and Adult Education, 18 credits in an emphasis area that is composed of Lifelong Learning and Adult Education and supporting courses outside Lifelong Learning and Adult Education, and 18 research credits, in addition to the residency requirement, qualifying, comprehensive, and final oral examinations, and continuous registration during the dissertation research. To earn the Ph.D. degree, doctoral students must also write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Students in the Ph.D. program focus on research in Globalization and Lifelong Learning, selecting one emphasis area (Distance Education, Literacy for Culturally and Linguistically Diverse Populations, Comparative Lifelong Learning, or Learning in Work and Communities). Required research methods courses help students develop the background knowledge and tools to enable them to engage in original research.

Dual-Titles

Dual-Title M.Ed., D.Ed., and Ph.D. in Lifelong Learning and Adult Education and Comparative and International Education

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Students must apply and be admitted to the graduate program in Lifelong Learning and Adult Education and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Comparative and International Education dual-title program. Refer to the Admission Requirements section of the Comparative and International Education (<http://bulletins.psu.edu/graduate/programs/majors/comparative-international-education/>) Bulletin page. Doctoral students must be admitted into the dual-title degree program in Comparative and International Education prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Lifelong Learning and Adult Education, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual-title in Comparative and International Education, listed on the Comparative and International Education (<http://bulletins.psu.edu/graduate/programs/majors/comparative-international-education/>) Bulletin page.

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Lifelong Learning and Adult Education and must include at least one Graduate Faculty member from the Comparative and International Education program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Lifelong Learning and Adult Education and Comparative

and International Education. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Lifelong Learning and Adult Education and Comparative and International Education dual-title Ph.D. student must include at least one member of the Comparative and International Education Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Comparative and International Education, the member of the committee representing Comparative and International Education must be appointed as co-chair. The Comparative and International Education representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their doctoral committee and reflects their original research and education in Lifelong Learning and Adult Education and Comparative and International Education. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the doctoral committee, the head of the graduate program, and the Graduate School.

Joint Degrees

Joint M.D./M.Ed. with the college of Medicine

Requirements listed here are in addition to requirements listed in GCAC-211 Joint Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-211-joint-degree-programs/>).

Admission Requirements

Those who wish to apply for admission to the joint M.D./M.Ed. degree program would have to meet the admission requirements for both the M.D./M.Ed. programs. Admissions requirements and applications for admission for Penn State College of Medicine are available at the M.D. Program (<http://med.psu.edu/md/>) section of the Penn State College of Medicine website. Prospective students interested in simultaneously pursuing an M.D. and M.Ed. first must apply to the Penn State College of Medicine M.D. program using the national American Medical College Application Service (AMCAS) application system and indicate their intent to pursue the M.D. degree at Penn State. Applicants can apply for admission to the joint degree during their first three years in the College of Medicine. Given that students will already be enrolled in the College of Medicine it will be possible for faculty to observe their academic record and counsel them on the advisability of the joint degree.

The general admission requirements for the M.Ed. degree are listed on the Admission Requirements tab. Joint M.D./M.Ed. candidates may substitute the MCAT for GRE or MAT scores. After the student has been accepted to the College of Medicine, s/he must apply and be admitted to the Graduate School (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>) for admission to the graduate program.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the M.D. program are listed on the M.D.

Program (<http://med.psu.edu/md/>) section of the Penn State College of Medicine website. Degree requirements for the M.Ed. degree are listed on the Degree Requirements tab. In accordance with the Graduate Council policy on Joint Degree Programs (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/joint-degree-programs/>), any nine credits from the M.D. program will meet the substitution requirement into the M.Ed., and any nine credits from the M.Ed. will be accepted into the M.D. program, from among the courses that reflect the interdisciplinary common ground between the two programs. It is to be noted that the course requirements for the joint degree are the same for students admitted to the M.Ed. in Lifelong Learning and Adult Education in the Medical and Health Professions option. If students accepted into the joint degree program are unable to complete the M.D. degree, they are still eligible to receive the M.Ed. degree if all the M.Ed. degree requirements have been satisfied.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

Those students interested in graduate assistantships can apply annually; applications are considered on a case-by-case basis.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up

deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Adult Education (ADTED) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/adted/>)

Learning Outcomes

Master of Education (M.Ed.)

1. **APPLY/CREATE:** Produce a brief, coherent prospectus on a topic area related to lifelong learning and adult education, supported by a logical rationale and relevant bodies of literature that may be used to examine this topic.
2. **THINK:** Execute a critical review of literature related to a research topic or issue in lifelong learning and adult education, articulate the key features of this review, provide a compelling rationale for pursuing this issue, and describe how to use it to examine the research topic or related issue.
3. **KNOW:** Demonstrate in-depth knowledge of the foundational issues, major theories, and methods that transect the field of lifelong learning and adult education.
4. **COMMUNICATE:** Articulate well-reasoned arguments and ideas with clarity in oral presentations and written formats and use the conventions of the discipline.
5. **PROFESSIONAL PRACTICE:** Illustrate knowledge of the professional and ethical standards for research and practice in the field of lifelong learning and adult education.

Doctor of Education (D.Ed.)

1. **KNOW:** Demonstrate in-depth knowledge of the foundational issues, major theories, and methods that transect the field of lifelong learning and adult education.
2. **KNOW:** Illustrate in-depth knowledge of an area of specialization within, or complementary to, the field of lifelong learning and adult education.
3. **THINK:** Design a rigorous research study that articulates a specific research problem, is situated in academic literature relevant to this problem, and employs a methodology appropriate for examining this problem.
4. **APPLY/CREATE:** Execute, in a rigorous, ethical fashion, an independent research project that significantly furthers knowledge and critically reflective practice in lifelong learning and adult education.
5. **COMMUNICATE:** Articulate well-reasoned arguments and ideas with clarity in oral presentations and written formats and use the conventions of the discipline.
6. **PROFESSIONAL PRACTICE:** Show awareness of how diversity, equity, inclusion and belonging relate to the field of lifelong learning and adult education.

Doctor of Philosophy (Ph.D.)

1. **KNOW:** Demonstrate in-depth knowledge of the foundational issues, major theories, and methods that transect the field of lifelong learning and adult education.
2. **KNOW:** Illustrate in-depth knowledge of an area of specialization within, or complementary to, the field of lifelong learning and adult education.
3. **THINK:** Design a rigorous research study that articulates a specific research problem, is situated in academic literature relevant to this

problem, and employs a methodology appropriate for examining this problem.

4. **APPLY/CREATE:** Execute, in a rigorous, ethical fashion, an independent research project that significantly furthers knowledge and critically reflective practice in lifelong learning and adult education.
5. **COMMUNICATE:** Articulate well-reasoned arguments and ideas with clarity in oral presentations and written formats and use the conventions of the discipline.
6. **PROFESSIONAL PRACTICE:** Show awareness of how diversity, equity, inclusion and belonging relate to the field of lifelong learning and adult education.

Contact

Campus	Harrisburg
Graduate Program Head	Susan Land
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Karin M Sprow Forte
Program Contact	Deborah Louise Klugh 777 W. Harrisburg Pike Middletown Middletown PA 17057 dlk33@psu.edu (717) 948-6213
Program Website	View (https://harrisburg.psu.edu/behavioral-sciences-education/lifelong-learning-adult-education-med/)
Campus	University Park
Graduate Program Head	Susan Land
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Heather Toomey Zimmerman
Program Contact	Susan Berzonsky 301 Keller Building University Park PA 16802 sfb11@psu.edu (814) 863-0095
Program Website	View (http://ed.psu.edu/lps/adult-education/)
Campus	World Campus
Graduate Program Head	Susan Land
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Heather Toomey Zimmerman
Program Contact	Whitney A DeShong 303 Keller Building University Park PA 16802 wad5021@psu.edu (814) 865-0473
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/adult-education-masters/overview/)

Marketing Analytics and Insights

Graduate Program Head	Margaret Meloy
Program Code	MMAI
Campus(es)	World Campus (M.Mkt.)
Degrees Conferred	Master of Marketing (M.Mkt.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=MMAI)

The Master of Marketing in Marketing Analytics and Insights program will prepare graduates to stand out in a competitive job market by studying at a highly reputed business school with some of the world's leading academic thinkers and industry experts. This program will provide students with marketing analytics capabilities essential for marketing managers and analysts for data-driven marketing organizations. Students will learn about marketing in a global environment, marketing analytics tools for data collection, management, visualization, and analysis, implementation of marketing analytics for marketing problems in the areas of digital marketing, customers, and brands, and ethical leadership. The program will be taught by the same world-class professors who teach our M.B.A. students. A solid foundation in marketing, marketing analytics, and ethics will make the target audience more attractive for positions of marketing manager or analyst in data-driven marketing organizations and prepare them to advance more rapidly into those positions. These learning outcomes will be achieved by a combination of lectures by faculty, invited guest lecturers, reading of key literature, individual and team projects, and practical involvement in a marketing analytics-based culminating experience.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

A completed online Graduate School Application for Admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>) is required, including:

- Minimum of two years relevant work experience is recommended. Exceptional students that fall outside the guidelines will be considered.
- Statement of purpose: a 2-3 page essay articulating career and educational goals.
- Résumé reflecting relevant experience.
- Official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>).
- Three professional references with complete contact information.
- Additional information may be requested by the program.

GMAT and/or GRE scores will not be required for admission. Accordingly, these scores will not be accepted.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Exceptions to GCAC-305 (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) will be considered by the program. Exceptions may or may not be granted by the Graduate School.

Degree Requirements

Master of Marketing (M.Mkt.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

A minimum of 30 credits at the 400, 500, or 800 level is required, with a minimum of 18 credits at the 500 or 800 level.

Code	Title	Credits
Required Courses		
The core MMAI courses are designed to teach students to think more strategically, assess external trends, learn from exemplar organizations, and enhance their ability to formulate, articulate, and implement strategy.		
BA 804	Ethical Leadership	3
MBADM 821	Marketing in a Global Environment	3
MKTG 540	Marketing Analytics	3
MKTG 811	Driving Business Success with Marketing Analytics	3
MKTG 812	Evaluating Marketing Communications in the Digital World	3
MKTG 813	Data-Driven Customer Acquisition & Retention	3
MKTG 814	Analytics for Brand Management and Customer Experience	3
Electives		
Students will also complete 6 credits of elective courses. A list of elective courses approved to count towards the degree requirements will be maintained by the program office.		6
Culminating Experience		
MKTG 815	Marketing Data Integration to Create Consumer Insights (Capstone)	3
Total Credits		30

The culminating experience for the degree is a capstone course, MKTG 815, that provides an opportunity for students to apply and integrate the knowledge and skills that were gained throughout the MMAI program. MKTG 814, a core course in this proposed degree program, is the capstone course for the Graduate Certificate in Marketing Analytics. This course is a culminating experience for the courses: MKTG 811, MKTG 812, and MKTG 813. MKTG 815 not only integrates student learnings from these courses, it will also integrate learnings from the other core courses in the master's degree program including MBADM 821, BA 804, and MKTG 540. MKTG 815 will be a required course

in the proposed Master of Marketing in Marketing Analytics and Insights degree. As it is the capstone course for the proposed master's program, MKTG 815 is not available as a required or elective course in any other program.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Marketing (MKTG) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/mktg/>)

Learning Outcomes

The Master of Marketing in Marketing Analytics and Insights Goals and Objectives:

1. Understanding the Role of Marketing in a Global Environment (KNOW)

MMAI graduates will examine strategic issues in global marketing, including opportunity analysis, planning, and implementation.

Learning Objectives:

- MMAI graduates will demonstrate the competency to think strategically about marketing issues and challenges and develop effective strategies for changing, complex environments.

- MMAI graduates will be able to analyze social, political, technological, economic, and global factors; evaluate industry and market structure; and assess organizational strengths and weaknesses.

2. Marketing Analytics Tools (APPLY/CREATE)

MMAI graduates will acquire the ability to identify and utilize the appropriate marketing analytic tools to gather, integrate, visualize, and analyze data.

Learning Objectives:

- MMAI graduates will develop principles of applied marketing analytics, including marketing data sources, data quality, software, and fundamentals of statistics.
- MMAI graduates will learn to integrate and visualize marketing-related data from disparate sources such as industry data, CRM and sales data, Google Analytics, social media, and consumer surveys.

3. Implementation of Marketing Analytics (THINK)

MMAI graduates will learn how to apply the marketing analytics tools in different marketing-related applications.

Learning Objectives:

- MMAI graduates will develop systematic and analytical approaches to marketing decision-making with modern-day enterprises in areas including, but not limited to, digital marketing analytics, customer analytics, and brand analytics.
- MMAI graduates will learn how to match marketing analytics tools with the appropriate research questions and data availability.

4. Communication of Insights from Marketing Analytics (COMMUNICATE)

MMAI graduates will learn how to bring insights obtained from marketing analytics to the marketing organization to drive data-driven decision making.

Learning Objectives:

- MMAI graduates will develop visualization skills to highlight key insights from implementations of marketing analytics.
- MMAI graduates will develop communication skills to convey marketing insights from marketing analytics to their marketing organization.

5. Ethical Responsibilities of Leaders (PROFESSIONAL PRACTICE)

MMAI graduates will be attuned to the ethical and social responsibilities of business leaders.

Learning Objectives:

- MMAI graduates will learn to consider and evaluate the ethical and societal implications of managerial decisions.
- MMAI graduates will cultivate a principled approach to leadership, valuing others' perspectives and acting with integrity.

Contact

Campus	World Campus
Graduate Program Head	Meg Meloy
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	J. Andrew Petersen
Program Contact	Michelle Kristen Rockower mkk114@psu.edu (814) 865-5290
Program Website	View (https://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-marketing-analytics-and-insights-masters-degree/overview/)

Mass Communications

Graduate Program Head	Anthony Olorunnisola
Program Code	MASSC
Campus(es)	University Park (Ph.D.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Dual-title Ph.D. in Mass Communications and Women's, Gender, and Sexuality Studies
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=MASSC)

The Ph.D. Program in Mass Communications is administered by the Donald P. Bellisario College of Communications. The purpose of the program is to prepare graduates for entry into college and university teaching and research and for a variety of communications-related professions. The program emphasizes the following seven areas of academic strength around which graduate students and their committees may wish to organize the selection of courses and program plans:

- Critical and Cultural Media Studies
- International, Global and Development Communications
- History, Law, Government and Politics
- Media Effects
- Science, Health and Environmental Media
- Strategic Communications
- Telecommunications, Technology and Information Policy

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

All students seeking admission to the program are required to submit Graduate Record Examination scores, official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>), and three letters of recommendation from individuals qualified to comment on their ability to perform successfully at the doctoral level. In most cases, a completed master's degree is

required for admission to the program. In addition, applicants are required to submit a formal statement indicating what they expect to achieve and how their educational background qualifies them for doctoral-level study in mass communications. Admission decisions are made by the college admissions committee.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Applicants to the Mass Communications Ph.D. program must have a minimum TOEFL score of 600 on the paper-based test to be considered for admission.

Degree Requirements

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Students admitted to the doctoral program must complete a qualifying examination. For students with a master's degree or equivalent, this examination ordinarily will occur before the student has completed 10 credits of doctoral-level work. For individuals admitted with only a baccalaureate degree and no graduate-level work, the qualifying examination will be administered after 30 credits and before 40 credits of graduate-level work have been completed. The committee designated to conduct the examination will determine whether the student's knowledge of mass communications is adequate for doctoral-level study, specify what deficiencies, if any, must be removed, and pass judgment on a proposed plan of study.

The program requirements include both semesters of the Mass Communications Proseminar (COMM 501), a foundation course and other courses selected by the student, with committee approval, that collectively constitute a coherent sequence appropriate to the advanced study of mass communications. Students are expected to take a minimum of 20 credits in communications-related courses. No more than 6 credits can be taken as independent study credits. Students also are required to take at least one course in research methods approved by the Ph.D. committee.

Upon completion of the course work approved for the plan of study, the candidate will take a comprehensive examination. Following the comprehensive examination, doctoral candidates schedule a dissertation proposal meeting at which the research plan for their dissertation is reviewed and approved by their committee. Upon completion of the dissertation, doctoral candidates present a final oral defense of their dissertations before their committees.

The communication and foreign language requirement for the Ph.D. degree may be satisfied by intermediate knowledge of one foreign language or by an equivalent research skill relevant to the student's field of study.

Dual-Titles

Dual-Title Ph.D. in Mass Communications and Women's, Gender, and Sexuality Studies

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

ADMISSION REQUIREMENTS

Students must apply and be admitted to the graduate program in Mass Communications and The Graduate School before they can apply for admission to the dual-title degree program. Applicants interested in the dual-title degree program may make their interest known on their applications to Mass Communications. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Women's, Gender, and Sexuality Studies dual-title program. Refer to the Admission Requirements section of the Women's, Gender, and Sexuality Studies Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/womens-gender-sexuality-studies/>). Doctoral students must be admitted into the dual-title degree program in WGSS prior to taking the qualifying examination in their primary graduate program.

DEGREE REQUIREMENTS

The Ph.D. in Mass Communications and WGSS is awarded only to students who are admitted to Mass Communications doctoral program and admitted to the dual-title degree in WGSS. To qualify for this dual-title, students must satisfy the requirements of the Mass Communications doctoral program, in which they are primarily enrolled, and of the WGSS dual-title program, the latter listed on the WGSS Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/womens-gender-sexuality-studies/>). Within this framework, final course selection is determined by the student and the CAS and WGSS advisers.

QUALIFYING EXAMINATION

Students must meet the Ph.D. qualifying examination requirements specified by the Mass Communications program. The dual-title field must be fully integrated into the qualifying exam for the doctoral program of Mass Communications. The qualifying examination committee for the dual-title Ph.D. degree must include two Graduate Faculty members from the Women's, Gender, and Sexuality Studies program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. Although this is not normally anticipated, because dual-title students may require an additional semester to fulfill all requirements, the qualifying exam may be delayed one semester beyond the normal period allowable.

PH.D. COMMITTEE COMPOSITION

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>), the Ph.D. committee of a Mass Communications and WGSS dual-title Ph.D. student must include at least two members of the WGSS Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in WGSS, a member of the committee representing WGSS must be appointed as co-chair.

COMPREHENSIVE EXAM

The WGSS faculty members on the student's committee will participate in developing and evaluating the student's comprehensive exams. The exam will incorporate written and oral components based on the student's

areas of interest and specialization and may include questions on a variety of WGSS-related scholarship, perspectives, and/or theoretical concepts. It will follow the basic Comprehensive Exam process in the Mass Communications as described in the Graduate Handbook.

DISSERTATION AND FINAL ORAL EXAMINATION

The candidate must complete a dissertation and pass a final oral examination of that dissertation on a topic that reflects original research in both MASSC and WGSS to earn the dual-title Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Communications (COMM) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/comm/>)

Learning Outcomes

1. Students will be able to distinguish among the major perspectives, theoretical concepts, and professional associations of mass-mediated communications research.

- Students will be able to design and complete an original research study in mass/mediated communications.
- Students will be able to create a teaching portfolio that summarizes their teaching experience and skills in mass/mediated communications courses.
- Students will present research at communications-related conferences and publish research in communications-related journals.
- Students will engage in academic and leadership activities within the College, University, and Profession.

Contact

Campus	University Park
Graduate Program Head	Anthony Olorunnisola
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Anthony Olorunnisola
Program Contact	Anthony Olorunnisola 201 Carnegie Bldg. University Park PA 16802 axo8@psu.edu (814) 863-7997
Program Website	View (http://comm.psu.edu/graduate/)

Materials Science and Engineering

Graduate Program Head	John Mauro
Program Code	MATSC
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Dual-Title Ph.D. in Materials Science and Engineering and Biogeochemistry
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=MATSC)

The Intercollege Graduate Degree Program in Materials Science and Engineering offers comprehensive graduate education in the fundamentals of materials science (synthesis-structure-property-performance relationships). Faculty have interests in many research areas including biomaterials, ceramics, composites and hybrids, computational materials science, electronic and photonic materials, materials chemistry and physics, metals, nanostructured and nanoscale materials, piezoelectrics and ferroelectrics, polymers and soft materials. Students may choose to study across the major themes of materials today including materials in energy applications, nanotechnology, materials in medicine, materials in communications, materials for sensor applications, structural materials, etc., by using a combination of MATSE courses and a myriad of materials-related courses offered in the science and engineering departments at Penn State.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to

Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Applicants with baccalaureate degrees in the physical sciences and engineering with a Junior/Senior grade point average of 3.2/4.0 or higher will be considered for admission.

Scores for the Graduate Record Examinations (GRE) are encouraged but not required for admission.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A minimum of 30 credits is required for the completion of the M.S. degree. At least 18 credits must be at the 500 or 600 level, and the remaining credits may be at the 400 or 800 level. There are 12 credits required in the following core courses:

Code	Title	Credits
Required Courses		
MATSE 501	Thermodynamics of Materials	3
MATSE 512	Principles of Crystal Chemistry	3
MATSE 542 or MATSE 503	Polymeric Materials: The Solid State Kinetics of Materials Processes	3
MATSE 582	Materials Science and Engineering Professional Development	1
MATSE 590	Colloquium	2
Electives		
The remaining elective credits may be chosen from a list of approved electives maintained by the program office.		12
Culminating Experience		
MATSE 600 or MATSE 596	Thesis Research Individual Studies	6
Total Credits		30

As a culminating experience for the M.S. degree, students may choose to complete either a thesis or a scholarly paper. Students who choose to complete a thesis must take at least 6 credits of thesis research (MATSE 600). A thesis describing independent research performed by the student must be written and defended at an oral examination. Bound copies will be made available for the University Libraries and the thesis adviser. A thesis committee will administer the final oral examination of the thesis. The committee must consist of at least three Graduate Faculty members. The thesis must be accepted by the committee members, the head of the graduate program, and the Graduate School, and the student must pass the thesis defense.

The non-thesis track is designed to be completed in 3 semesters, or one calendar year (fall, spring, and summer). Students in this program will be required to begin in the fall semester and be registered continuously

until the culminating research experience is completed at the end of the summer. A research adviser will be assigned to students in their first semester. Students in the non-thesis option must write a satisfactory scholarly paper while enrolled in MATSE 596. A total of 6 credits of MATSE 596 will be taken, 1 credit each in the fall and spring, and 4 credits in the summer. It is expected that the scholarly paper will be submitted and approved at the end of the summer semester. Students who need more time to complete the final paper will be allowed to complete the paper, and have it reviewed and approved after the third semester has ended. Students are not required to remain in residence while they complete the final paper. However, extensions granted to students in this program must comply with the Graduate Council policy on deferred grades (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-400/grading-system/>).

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A doctoral program consists of a combination of courses, seminars, and research that fulfills the minimum requirements of Graduate Council and is approved by the Ph.D. committee for each individual student. A master's degree is not a prerequisite for the doctorate. However, the first year of graduate study leading to the Ph.D. may be the same as that provided for the M. S. degree. Acceptance into the Ph.D. program is based on the student's performance on the Ph.D. qualifying exam, which is administered by a graduate qualifying exam committee of the department.

A minimum of 18 credits of 500-level courses is required for completing a Ph.D. degree in Materials Science and Engineering, including 9 credits in required core courses:

Code	Title	Credits
Required Courses		
MATSE 501	Thermodynamics of Materials	3
MATSE 503	Kinetics of Materials Processes	3
MATSE 512	Principles of Crystal Chemistry	3

Ph.D. students are also required to take 2 credits of MATSE 590 each year, and complete MATSE 582; credits for MATSE 582 and MATSE 590 will not count towards the minimum 18 credits required. Additional specific course requirements are determined by the student and the adviser in consultation with the student's Ph.D. committee. A student with an M.S. degree from Penn State can use credits earned during his or her M.S. study to fulfill the Ph.D. course requirements. Upon approval by the Ph.D. committee and the graduate program coordinator, some or all of the course requirements may be waived for students holding an M.S. degree from another institution.

Dual-Titles

Dual-title Ph.D. in Materials Science and Engineering and Biogeochemistry

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Students must apply and be admitted to the graduate program in Materials Science and Engineering and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Biogeochemistry dual-title program. Refer to the Admission Requirements section of the Biogeochemistry Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/biogeochemistry/>). Doctoral students must be admitted into the dual-title degree program in Biogeochemistry prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Materials Science and Engineering. In addition, students must complete the degree requirements for the dual-title in Biogeochemistry, listed on the Biogeochemistry Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/biogeochemistry/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Materials Science and Engineering and must include at least one Graduate Faculty member from the Biogeochemistry program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Materials Science and Engineering and Biogeochemistry. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Materials Science and Engineering and Biogeochemistry dual-title Ph.D. student must include at least one member of the Biogeochemistry Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Biogeochemistry, the member of the committee representing Biogeochemistry must be appointed as co-chair. The Biogeochemistry representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Materials Science and Engineering and Biogeochemistry. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/>).

graduate-education-policies/), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Graduate assistantships are not available to students in the accelerated MATSC M.S. track.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Materials Science and Engineering (MATSE) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/matse/>)

Learning outcomes

Master of Science (m.S.)

1. **KNOW:** Demonstrate appropriate breadth and depth of fundamental knowledge in materials science and engineering.
2. **THINK:** Review and critically analyze the ideas of other scientists and engineers, especially those addressing problems closely related to their own research.
3. **APPLY/CREATE:** Apply the scientific method using laboratory, computational and/or theoretical techniques to create new knowledge in material science and engineering or to design new materials.
4. **COMMUNICATE:** Effectively communicate unanswered questions about materials in writing and oral presentations; express the scientific and societal impact of their work; and disseminate new knowledge through archived publications, such as articles and theses.
5. **PROFESSIONAL PRACTICE:** Employ the highest ethical and professional standards, and the best practices in laboratory safety, in all research and academic endeavors.

Doctor of Philosophy (Ph.D.)

1. **KNOW:** Demonstrate appropriate breadth and depth of fundamental knowledge in materials science and engineering.
2. **THINK:** Review and critically analyze the ideas of other scientists and engineers, especially those addressing problems closely related to their own research.
3. **APPLY/CREATE:** Apply the scientific method using laboratory, computational and/or theoretical techniques to create new knowledge in material science and engineering or to design new materials.
4. **COMMUNICATE:** Effectively communicate unanswered questions about materials in writing and oral presentations; express the scientific and societal impact of their work; and disseminate new knowledge through archived publications, such as articles and theses.
5. **PROFESSIONAL PRACTICE:** Employ the highest ethical and professional standards, and the best practices in laboratory safety, in all research and academic endeavors.

Contact

Campus	University Park
Graduate Program Head	John C Mauro
Program Contact	Sue Hyde 225 Steidle Building University Park PA 16802 esh17@psu.edu (814) 865-9857
Program Website	View (http://www.igdpmatse.psu.edu/)

Mathematics

Graduate Program Head	Pierre-Emmanuel Jabin
Program Code	MATH
Campus(es)	University Park (Ph.D., M.A.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Arts (M.A.) Dual-Title Ph.D. and M.A. in Mathematics and Operations Research
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=MATH)

Graduate courses in all the principal branches of mathematics are offered regularly each year. The department is prepared to direct research in a variety of fields, including various branches of analysis, algebra, topology, number theory, applied analysis, and mathematical logic and foundations.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Scores from the Graduate Record Examinations Aptitude Test (GRE), or from a comparable substitute examination accepted by the Mathematics graduate program, are not required for admission. Those scores can still

be included if the applicant has them and they will then be considered by the admission committee.

To be admitted to the Ph.D. program without undergraduate deficiency, an applicant should have completed at least 18 credits in mathematics at the advanced undergraduate level (400 series or their equivalents). The undergraduate student is urged to take at least 6 credits in foundations of analysis (MATH 401), 6 in modern algebra (MATH 435 and MATH 436), and 3 in topology (MATH 429) or their equivalents. These courses are essential preparation for the graduate program, and if they are taken after admission, a maximum of 6 credits may be counted toward an advanced degree. Students are typically admitted directly to the Ph.D. program, though may on occasion be admitted first to the M.A. degree when not meeting all of the above requirements.

Students with a 3.00 junior/senior average and with appropriate course backgrounds will be considered for admission. The best-qualified applicants will be accepted up to the number of spaces that are available for new students.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of Arts (M.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

For the M.A. degree the department offers two options:

1. the thesis option requires 12 credits of approved 500-series or 600-series courses in mathematics, 6 to 9 credits of thesis, sufficient credits in approved 400- or 500-series courses to make a total of 30 credits, and a final oral examination based on the thesis and general course material; and
2. the nonthesis option requires 18 credits of 500-series courses in mathematics, sufficient credits in approved 400- or 500-series courses to make a total of 30 credits, and a term paper on an approved topic in mathematics. No final examination is given in this option. Under this option a student may also elect to take a minor in applied mathematics (9 credits with at least 6 at the 500 level) and may use these credits toward the necessary 30 credits. For both options, a grade of A or B is required in all courses.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

All doctoral students are required to take three qualifying examinations. Two of these examinations must be completed prior to the beginning of the student's second year of graduate study, and the third prior to the beginning of the third year. The qualifying examinations are in the areas of analysis, algebra, and topology/geometry.

The qualifying examinations are given twice a year—after the end of the spring semester and before the beginning of the fall semester. Basic, one-

year sequences are offered in each subject annually to help students prepare for the examinations. Typically, an entering Ph.D. student takes two of the basic sequences in the first year and the third basic sequence in the second year of study, and takes the qualifying examinations in the spring after completing the corresponding courses. If an examination is failed, the student must take it again. Students who fail a qualifying examination in a given subject twice may not continue in the Ph.D. program.

Entering Ph.D. students may take one or more of the qualifying examinations on arrival in August without penalty. If they fail a pre-entrance exam, they still have two more opportunities to pass it. Entering Ph.D. students are advised to take at least two basic sequences (in the subjects they did not pass qualifying exams in on arrival) and the subsequent qualifying exams in the first year of graduate study.

After passing all three qualifying exams, students are expected to select a dissertation adviser and form a Ph.D. committee. The committee administers the comprehensive exam (no later than the end of the seventh semester of study) and offers counsel of the student as his or her research progresses.

Dual-Titles

Dual-Title M.A. and Ph.D. in Mathematics and Operations Research

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Students must apply and be admitted to the graduate program in Mathematics and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Operations Research dual-title program. Refer to the Admission Requirements section of the Operations Research Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>). Doctoral students must be admitted into the dual-title degree program in Operations Research prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Mathematics. In addition, students must complete the degree requirements for the dual-title in Operations Research, listed on the Operations Research Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Mathematics and must include at least one Graduate Faculty member from the Operations Research program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Mathematics and Operations Research. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Mathematics and Operations Research dual-title Ph.D. student must include at least one member of the Operations Research Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Operations Research, the member of the committee representing Operations Research must be appointed as co-chair. The Operations Research representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Mathematics and Operations Research. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up

deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Mathematics (MATH) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/math/>)

Contact

Campus	University Park
Graduate Program Head	Pierre-Emmanuel Jabin
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Pierre-Emmanuel Jabin
Program Contact	Katie Greenland 107A McAllister Building University Park PA 16802 kle16@psu.edu (814) 865-7527
Program Website	View (https://science.psu.edu/math/graduate/admission/)

Mechanical Engineering (Capital)

Graduate Program Head	Vahid Motevalli
Program Code	MCENG
Campus(es)	Harrisburg (M.S.)
Degrees Conferred	Master of Science (M.S.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=MCENG)

Penn State Harrisburg (PSH) is located within a short commute from York, Lancaster, Carlisle, Reading, and Harrisburg industrial centers concentrated on manufacturing, engineering consulting, product design, and development. The Master of Science in Mechanical Engineering degree program is designed to provide support for industrial research needs, as well as offer an avenue for Penn State Harrisburg B.S. ME graduates to continue their education in the south central Pennsylvania region. The program is accessible to engineering professionals who wish to pursue advanced studies without giving up their current employment. The program may be completed on a full-time or part-time basis. Classes are typically scheduled weekly in three-hour evening sessions, offering a convenient format for career professionals seeking to enroll part time. Whenever possible, the program will take advantage of the specialized equipment and research facilities available in the local industries to enhance the training of M.S. ME students.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Admission into the Master of Science (M.S.) Mechanical Engineering program will be granted only to candidates who demonstrate high potential for success in graduate studies. Applicants should have undergraduate degrees in engineering or technology fields from an accredited university and must meet the admission requirements as set by Penn State's Graduate School.

An undergraduate cumulative grade-point average of 3.0 or better on a 4.0 scale, and scores from the GRE are required for admission.

Applicants should submit the following:

- a completed Graduate School online application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) with the nonrefundable application fee;
- official transcripts from all post-secondary institutions attended (<http://gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>);
- three (3) letters of professional recommendations from individuals who can evaluate the applicant’s potential;
- a personal statement of professional interest, goals, and experience;
- test scores from the Graduate Record Examination (GRE);
- statement of interest in graduate assistantship, if desired.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A minimum of 31 credits at the 400, 500, 600, or 800 level is required, including 24 course credits with at least 15 credits at the 500 level, 1 credit of ME 590, and 6 credits of thesis research (ME 600 or ME 610).

Code	Title	Credits
Required Courses		
EMCH 524A	Mathematical Methods in Engineering	3
ME 590	Colloquium	1
Students take 9 credits in one of the following concentrations. A list of courses that will count towards these concentrations is maintained by the program office.		9
Thermo-Fluids Science		
Mechanical Science		
Materials Science		
Electives		
Students take 12 credits of electives from a list of approved electives maintained by the program office. To incorporate breadth into the program, students are required to take at least one elective course in a Concentration Area other than the one they complete.		12
Culminating Experience		
ME 600	Thesis Research	6
or ME 610	Thesis Research Off Campus	
Total Credits		31

A maximum of 3 400-level courses (9 credits) can be counted towards the degree requirements for the M.S. A minimum of 12 credits must be earned in 400- and 500-level courses in Mechanical Engineering.

Students who have deficiencies in the use of spoken or written English may be required to take courses in these areas in addition to the specified degree requirements. Credits earned to remediate deficiencies cannot be applied towards requirements for the M.S. degree.

Degree requirements must be completed within six years of admission to degree status.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master’s (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master’s (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School’s website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Mechanical Engineering (ME) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/me/>)

Learning Outcomes

1. **KNOW** - Graduates will be able to demonstrate broad mastery of core principles in mechanical engineering as well as in-depth mastery in selected mechanical engineering topics.
2. **CRITICAL THINKING** - Graduates will be able to critically and creatively conceptualize, evaluate and formulate mechanical engineering problems, as well as perform the analyses required for problem definition..

- 3. APPLY/CREATE** - Graduates will be able to apply advanced knowledge, techniques, skills and state of the practice tools to solve mechanical engineering problems.
- 4. COMMUNICATE** - Graduates will be able to effectively communicate, both orally and in writing, project outcomes, such as ideas, requirements, designs, analyses, findings, and justification for decisions.
- 5. PROFESSIONAL PRACTICE** - Graduates will be able to demonstrate an understanding of professional and ethical responsibility and conduct themselves accordingly.

Contact

Campus	Harrisburg
Graduate Program Head	Vahid Motevalli
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Brian Allen Maicke
Program Contact	Casey M. McDowell W 239 Olmsted- Penn State Harrisburg 777 W Harrisburg Pike Middletown PA 17057 cmm8969@psu.edu (717) 948-6116
Program Website	View (https://harrisburg.psu.edu/science-engineering-technology/me-met/masters-science-mechanical-engineering/)

Mechanical Engineering (Engineering)

Graduate Program Head	Mary Frecker
Program Code	ME
Campus(es)	University Park (Ph.D., M.S.) World Campus (M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=ME)

Graduate programs and research facilities are available in combustion, heat transfer, fluid mechanics, energy storage, dynamic system analysis, robotics, mechanical design, energy systems, biomedical applications, and micro-nano applications. Air pollution control, automotive safety, tribology, designing for noise control and for reliability also provide many research and design opportunities.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

To maintain a high quality program, it is important that our students are also of a caliber to succeed. As such, the admission requirements for the students enrolling in the online program will not differ from those

of our resident students. Online students will only be accepted into the program with approval from the Department's Admissions Committee. Within the Department, the ME Admissions Committee (made up of ME Graduate Faculty) will provide recommendations to the Professor-in-Charge of Graduate Studies on accepting students to the MSME degree program. It is expected that students have a Bachelor of Science degree in a suitable engineering field from a U.S. regionally accredited institution or from an officially recognized degree-granting international institution. Admission decisions will also be based upon relevant work experience and recommendation letters. GRE scores will not be accepted.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The M.S. degree program is designed for students to gain advanced knowledge for research, analysis, and design in mechanical engineering.

Resident students pursuing an M.S. degree may choose one of two options: completion of 24 course credits and the submission of a thesis (6 credits) to the Graduate School, or 30 course credits and the submission of a scholarly paper to the department. The M.S. degree program is also offered on-line in which only the 30 course credits and the submission of a scholarly paper is permitted. The requirements for the M.S. M E degree program are:

- Minimum of 30 course credits at the 400 level or higher, of which 20 course credits must be earned at Penn State. Note that 2 additional credits are required by enrolling in the ME 590 Colloquium but these 2 additional credits do not count toward the 30 course credits. The required course credits must be completed with a grade point average of 3.00 or higher.
- All students must successfully complete two credits of ME 590 Colloquium preferably in their first two semesters in the program. These two colloquium credits do not count toward the 30 course credits in Requirement 1 above.
- At least 18 credits in 500- and 600-level courses.
- A minimum of 12 credits in 400- and 500-level courses in Mechanical Engineering, excluding ME 410, ME 440W, ME 441W, ME 442W, ME 443W, ME 450, and any other required undergraduate courses. ME 596 cannot be used to fulfill this requirement.
- The MSME requires three credits of mathematics. These credits must be taken from the following group of courses:

Code	Title	Credits
EMCH 524A	Mathematical Methods in Engineering	3
EMCH 524B	Mathematical Methods in Engineering	3
ME 512	Heat Transfer--Conduction	3
ME 550	Foundations of Engineering Systems Analysis	3
400- and 500-level MATH courses (MATH 4XX, MATH 5XX) except the following:		
MATH 419	Theoretical Mechanics	

MATH 427	Foundations of Geometry
MATH 428	Geometry for Teachers
MATH 435	Basic Abstract Algebra
MATH 451	Numerical Computations
MATH 455	Introduction to Numerical Analysis I
MATH 456	Introduction to Numerical Analysis II
MATH 461	
MATH 470	Algebra for Teachers
MATH 471	Geometry for Teachers
MATH 475Y	History of Mathematics
MATH 482	Mathematical Methods of Operations Research
MATH 484	Linear Programs and Related Problems

Courses with specific focus on numerical analysis will not count toward the mathematics requirement.

- A thesis or paper must be presented to meet the specific requirement of the culminating experience type selected; the paper may take the form of a doctoral research proposal if agreed upon in advance by the student and the graduate adviser. Online students seeking an MSME degree will only be permitted to write a paper.
- Preparatory course(s) required for teaching assistants (such as ENGR 888), remedial courses, and any courses required in our undergraduate program are not counted toward degree requirements.

CULMINATING EXPERIENCE OPTION A - M.S. THESIS

Candidate registers for a minimum of six credits of ME 600 or ME 610 and submits a thesis following the procedures specified by the Graduate School. This program will consist of at least 24 course credits of which 18 credits must be at the 500 level (not including ME 596), and six thesis credits. At least 12 credits must be 400- or 500-level Mechanical Engineering courses.

CULMINATING EXPERIENCE OPTION B - M.S. PAPER

Candidate registers for 30 course credits of which 18 credits must be at the 500 level. A maximum of three credits of ME 596 can be counted in the total of 30 credits. At least 12 credits must be 400- or 500-level Mechanical Engineering courses. Candidates write a paper on a topic mutually agreed upon by the adviser suitable for publication in a professional journal or presentation at a national or international conference.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The Ph.D. program emphasizes scholarly research and helps students prepare for research and related careers in industry, government, and academe. Students must pass written and oral qualifying examinations. The Ph.D. program is quite flexible, with minimal formal requirements. The Ph.D. is awarded upon completion of a program of advanced study that includes a minimum period of residence, a satisfactory dissertation, and the passing of comprehensive and final oral examinations as determined by the student's Ph.D. committee.

Generally, a Ph.D. student must have 30 credits above a master's degree before taking the comprehensive examination.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Graduate students are supported by a variety of government and industry fellowships, traineeships, and research and teaching assistantships. Stipends vary depending on the source. Competition for support is extremely keen; however, outstanding students are considered for attractive offers of support, including various fellowships specifically for new students in the College of Engineering. By completing the department's application for financial assistance, you will automatically be considered for a graduate assistantship. To receive full consideration for financial aid, all application materials should be submitted by December 15.

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Mechanical Engineering (ME) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/me/>)

Contact

Campus	University Park
Graduate Program Head	Mary I Frecker
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Robert Francis Kunz
Program Contact	Megan B. Peters 127 Reber Building University Park PA 16802 mbp5460@psu.edu (814) 865-1345
Program Website	View (http://www.me.psu.edu/)
Campus	World Campus
Graduate Program Head	Mary I Frecker
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Robert Francis Kunz
Program Contact	Megan B. Peters 127 Reber Bldg. University Park PA 16802 mbp5460@psu.edu (814) 865-1345
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/mechanical-engineering-masters/overview/)

Media Studies

Graduate Program Head	Anthony Olorunnisola
Program Code	MEDIA
Campus(es)	University Park (M.A.)
Degrees Conferred	Master of Arts (M.A.) Dual-Title M.A. in Media Studies and Women's, Gender, and Sexuality Studies Integrated B.A./B.S. in Communication Arts and Sciences and M.A. in Media Studies Integrated B.A./M.A. in Media Studies Joint J.D./M.A. with Penn State Law
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=MEDIA)

The master's degree in Media Studies is an academic program that involves students in the systematic study of media. The objective of the course of study is to enable students to achieve a comprehensive understanding of the systems, networks, cultures, and information associated with media. The program prepares students for doctoral study in communications and for professional positions in business and government requiring a comprehensive understanding of the historical, social, and political implications of the media. This program helps prepare students to organize research projects, critically evaluate research reports, and directly influence media practices by the application of research findings. The M.A. Program in Media Studies is administered by the Donald P. Bellisario College of Communications.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Scores from the Graduate Record Examinations (GRE) are required for admission. Students with a 3.00 junior/senior grade-point average are eligible for admission. Three letters of recommendation are required. Applicants must also submit an autobiographical statement of about 1,000 words indicating the nature of the applicant's interest in Media Studies, reasons for wanting to do graduate work, and future aspirations relating to the field of mass communications. Experience shows that most applicants hold a bachelor's degree in a field of the liberal arts or the social and behavioral sciences, including journalism and mass communications. However, this does not preclude applicants with other backgrounds, abilities, and interests such as those whose undergraduate training may have been in a scientific or technical field. In every case, the applicant should explain in the autobiographical statement how his or her undergraduate education relates to the decision to seek admission to graduate study in mass communications.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Applicants to the Media Studies program must have a score of 24 or higher on the speaking section of the TOEFL Internet-based test.

Degree Requirements

Master of Arts (M.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The M.A. program seeks to integrate two areas of inquiry and analysis. The "Critical Studies" area centers on the expressive, creative, and linguistic dimensions of media as cultural processes. The "Political Studies" area focuses primarily on the political and economic dimensions of national and international communications systems and processes. The student is encouraged to combine courses from these and possibly other areas into a coherent package of course work culminating in either a thesis or a master's paper.

Degree Requirements

A minimum of 36 credits is required for the completion of the M.A. degree. Students in the thesis track must complete at least 18 credits at the 500 or 600 level, and the remaining credits may be at the 400 or 800 level. Students in the non-thesis track must complete 18 credits at the 500 level, and the remaining credits may be at the 400 or 800 level. There are 7 credits required in the following core courses:

Code	Title	Credits
Required Courses		
COMM 506	Research Methods in Communications	3
or COMM 511	Qualitative Research Methods in Mass Communications	

COMM 515	MA Proseminar in Mass Communications	3
COMM 590	Colloquium	1

Electives

Additional courses that will count as electives towards this degree can be chosen from a list of approved elective courses maintained by the graduate program office. Course work offered by departments outside the College of Communications may be scheduled as part of the student's program with prior approval of the student's academic committee.

Culminating Experience

Students choose to complete a thesis or a master's paper.

COMM 600	Thesis Research or COMM 610 Thesis Research Off Campus
COMM 596	Individual Studies (Master's Paper)

If the student chooses to write a thesis, at least 6 credits in thesis research (COMM 600 or COMM 610) must be taken. Students in the non-thesis track must write a satisfactory master's paper, while enrolled in COMM 596. In some cases, students may be required to take additional credits in order to make up deficiencies in undergraduate course work.

Students are required to schedule three separate, formal meetings with their advisers and the academic committees for (1) discussion and approval of the general program plan, (2) the thesis or master's paper proposal, and (3) the defense of the thesis or paper. In most cases, satisfactory completion of course work and thesis requires two years. A thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School, and the student must pass a thesis defense. A master's paper must be accepted by the advisers, committee members and the graduate programs chair, and the students must pass a master's paper defense.

Dual-Titles

DUAL-TITLE M.A. IN MEDIA STUDIES AND WOMEN'S, GENDER, AND SEXUALITY STUDIES

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

ADMISSION REQUIREMENTS

Students must apply and be admitted to the graduate program in Media Studies and The Graduate School before they can apply for admission to the dual-title degree program. Applicants interested in the dual-title degree program may make their interest known on their applications to Media Studies. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Women's, Gender, and Sexuality Studies dual-title program. Refer to the Admission Requirements section of the Women's, Gender, and Sexuality Studies Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/womens-gender-sexuality-studies/>).

DEGREE REQUIREMENTS

To qualify for the dual-title degree, students must satisfy the degree requirements of the Media Studies program (thesis option), in which they are primarily enrolled, and of the WGSS dual-title program, listed on the WGSS Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/womens-gender-sexuality-studies/>). Within this framework, final course selection is determined by the student and the Media Studies and WGSS advisers. The candidate must complete a thesis and follow

the requirements for the thesis option in Media Studies; this includes passing a final oral defense of that thesis on a topic that reflects original research in both Media Studies and WGSS to earn the dual-title M.A. degree. Candidates for the dual-title M.A. degree in Women's, Gender, and Sexuality Studies must have at least one member of the WGSS Graduate Faculty on their master's advising committee.

Integrated Undergrad-Grad Programs

Integrated B.A./B.S. in Communication Arts and Sciences and M.A. in Media

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

This Integrated Undergraduate/Graduate (IUG) degree program combines either the B.A. or B.S. in Communication Arts and Sciences with the M.A. in Media Studies offered at the following campuses:

Undergraduate Degree

- Berks (B.A)
- Brandywine (B.A.)
- University Park (B.A. or B.S.)

Graduate Degree

- University Park

The graduate portion of this IUG is currently offered as face-to-face residential instruction. While the undergraduate curriculum for this IUG may be completed at multiple campuses, the ease and feasibility of completing the integrated program may be heavily dependent upon the location of the graduate instruction. Please discuss the feasibility of completing the IUG with a representative for the graduate program before beginning the application process.

The Department of Communication Arts and Sciences and the Donald P. Bellisario College of Communications offers academically qualified students the opportunity to complete either a B.A. or B.S. degree in the Department of Communication Arts and Sciences (CAS) and an M.A. in Media Studies (MEDIA) in approximately five years of study. Students admitted into this IUG utilize the scholarly connections between the programs and develop an integrated course of study that is shaped for specific interests that cross the two programs.

The Department of Communication Arts and Sciences offers both humanities and social science-based approaches to human communication, including interpersonal communication, small-group communication, public address and rhetoric, political communication, organizational communication and health communication. The Donald P. Bellisario College of Communications emphasizes mediated phenomenon, with an M.A. program that pulls from the graduate faculty of four undergraduate departments: Advertising/Public Relations; Film Production/Media Studies; Journalism; and Telecommunications/Media Industries. Particular combinations of CAS/MEDIA can flow well together in a combined IUG from the two programs, such as advertising and health communication; media effects and interpersonal communication; and qualitative media studies and rhetoric. Both the undergraduate CAS and the graduate Media Studies programs allow significant flexibility for IUG students to create an individual combination that works best for

their interests. Graduates of this IUG may leverage their credentials for industry positions in marketing, political consulting, data analysis and other industry and non-profit careers, and for applying to Ph.D. programs in Communication and to J.D. programs in Law Schools.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students must apply to the program via the Graduate School application for admission (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet all the admission requirements of the Graduate School and the Media Studies graduate program for the Master of Arts degree. Admission is selective based on criteria established by the leadership of Bellisario College and CAS. Though exceptions are possible, student applicants will generally have a minimum overall GPA of 3.5 in their major and overall at the time of application (on a 4.0 scale).

Fall admission is recommended, although Spring may be considered in unusual cases. Generally, applications will be accepted with all other graduate applications for Fall admission, although admission starting in the Spring semester may be considered for unusual cases.

Applicants to the integrated program:

1. Must be enrolled in the B.A. or B.S. program in Communication Arts and Sciences
2. Must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.
3. Must provide a narrative statement explaining why they want to participate in this program and why they are qualified to do so
4. Must arrange for at least two letters of recommendation (at least one from a Department of Communication Arts and Sciences faculty member)
5. Must provide a writing sample
6. Must provide a resume/curriculum vitae

Advising

The students will complete a Program Proposal Meeting during Year 4 with their CAS undergraduate adviser and three faculty members of the student's graduate committee, including an adviser. The student's M.A. graduate committee will consist of three graduate faculty members (unless special exemption is granted from the Graduate School), and including two co-advisers, one from each participating unit. Each student will have a primary adviser in Bellisario who will work with the student on the M.A. requirements and their thesis, and a co-adviser in CAS to ensure successful completion of the IUG degree.

Sequence of Courses

During the first three years of study students will follow the basic course sequence provided for by the existing B.A. plan in CAS. In the fourth year of study they will take four courses that will count both toward the B.A. in CAS and the M.A. in Media Studies. At least two of these courses must be at the 500 level. Students may also take additional Media Studies

courses in their fourth year beyond these two, but these credits will count only toward the M.A. degree.

Plan of Study

Prior to admission in the program, and in consultation with their CAS undergraduate adviser and Bellisario Graduate Coordinator, students must prepare a preliminary plan of study for years 4 and 5 of the program. The students will complete a revised plan of study during a required Program Proposal Meeting in Year 4. The plan is periodically reviewed by the student and advisers, and revised as necessary. Students will complete all requirements for the B.A. in CAS and complete some graduate level Media Studies requirements in the first four years and take only Media Studies courses in year 5.

An integrated undergraduate/graduate semester report will be completed and submitted at the end of each semester of the IUG program.

Graduating IUG students must submit the semester report at the beginning of the semester of graduation. The report form is available online at Graduate Enrollment Services Documents and Forms (<http://www.gradschool.psu.edu/faculty-and-staff/forms/ges/>).

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.A. or B.S. in Communication Arts and Sciences are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.A. degree are listed on the Degree Requirements tab. Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students must complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.A. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
CAS 403	Interpersonal Communication Theory and Research	3
CAS 404	Conflict Resolution and Negotiation	3
CAS 405	Family Communication Theory and Research	3
CAS 409	Democratic Deliberation	3
CAS 415	Rhetoric of Film and Television	3
CAS 420	Rhetorical Theory	3
CAS 421	Communication and Aging	3
CAS 422	Contemporary African American Communication	3
CAS 426W	Communication Ethics	3
CAS 450W	Group Communication Theory and Research	3
CAS 452W	Organizational Communication Theory and Research	3

CAS 453	Health Communication Theory and Research	3
CAS 455	Topics in Gender and Communication	3
CAS 471	Intercultural Communication Theory and Research	3
CAS 475	Studies in Public Address	3
CAS 478	Contemporary U.S. Political Rhetoric	3
CAS 483	Communication and Information Technology II	3
CAS 494	Research Topics	1-12
CAS 497	Special Topics	1-9
COMM 504	Seminar in the History of Mass Communication	3
COMM 505	International Communication Problems	3
COMM 506	Research Methods in Communications	3
COMM 507	News Media and Public Opinion	3
COMM 511	Qualitative Research Methods in Mass Communications	3
COMM 512	Government and Mass Communications	3
COMM 513	Constitutional Problems of the News Media	3
COMM 514	Political Economy of Communications	3
COMM 515	MA Proseminar in Mass Communications	3
COMM 516	Introduction to Data Analysis in Communications	3
COMM 517	Psychological Aspects of Communication Technology	3
COMM 518	Media Effects	3
COMM 520	Seminar in Advertising Problems	3
COMM 521	Advertising Perspectives	3
COMM 522	Social and Cultural Aspects of Advertising	3
COMM 550	Film Theory and Criticism	3
COMM 553	Special Problems in Film and TV	1-3
COMM 555	Media and Culture	3
COMM 556	Reading Film	3
COMM 580	Seminar in Telecommunications	3
COMM 582	Ethics and Emerging Communications Technology	3
COMM 585	Media & Telecommunications Industries	3
COMM 594	Research Topics	1-15
COMM 595	Internship	1-18
COMM 597	Special Topics	1-9

Integrated B.A./M.A. in Media Studies

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.A. in Media Studies with the M.A. in Media Studies offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- University Park

The Donald P. Bellisario College of Communications offers academically qualified students enrolled in a Bachelor of Arts program in the College

of Communications the opportunity to earn both the B.A. and the M.A. upon completion of five years of study. The Integrated Undergraduate-Graduate Program in Media Studies facilitates the advanced study of communications research and thesis development through a carefully organized selection of undergraduate courses, graduate seminars and directed research projects. The program accelerates and enhances undergraduate students' appreciation for graduate level scholarship by involving them in the seminars, research activities, and the scholarly discourse of the college's community of master's- and doctoral-level scholars.

The Integrated B.A./M.A. degree in Media Studies is an academic program that involves students in the systematic study of media. The objective of the course of study is to enable students to achieve a comprehensive understanding of the systems, networks, cultures, and information associated with media. The program prepares students for doctoral study in communications and for professional positions in business and government requiring a comprehensive understanding of the historical, social, and political implications of the media, and research methods for studying the media. This program helps prepare students to organize research projects, critically evaluate research reports, and directly influence media practices by the application of research findings. The program is specifically not intended for advanced professional education.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students must apply to the program via the Graduate School application for admission (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet all the admission requirements of the Graduate School and the Media Studies graduate program for the Master of Arts degree.

Applicants must have a minimum GPA of 3.5 in order to be admitted; 3 credits from COMM's General Education courses (COMM 150N, COMM 180, COMM 320, or COMM 370); and 3 credits from the COMM 200 level and above. Admission to the program is based on the evaluation of the student's transcript, examples of completed writing and research projects, a narrative statement of objectives, and two letters of support from faculty with whom they have worked. One faculty member must be from the College of Communications. Applicants are expected to present records of outstanding scholarly achievement to qualify.

Applicants to the Integrated Program

1. Must be enrolled in a B.A. program in the College of Communications.
2. Must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.
3. Must provide a narrative statement of objectives and two letters of endorsement from faculty with whom they have worked. One faculty member must be from the College of Communications.
4. In consultation with an adviser, students must prepare a plan of study appropriate to this integrated program. Students must present their plan of study to the head of the graduate program or the appropriate committee overseeing the integrated program prior to being admitted.

to the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.A. in Media Studies are listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.A. degree are listed on the Degree Requirements tab. Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
<i>Graduate Credits</i>		
COMM 504	Seminar in the History of Mass Communication	3
COMM 506	Research Methods in Communications	3
COMM 507	News Media and Public Opinion	3
COMM 511	Qualitative Research Methods in Mass Communications	3
COMM 512	Government and Mass Communications	3
COMM 513	Constitutional Problems of the News Media	3
COMM 514	Political Economy of Communications	3
COMM 515	MA Proseminar in Mass Communications	3
COMM 516	Introduction to Data Analysis in Communications	3
COMM 517	Psychological Aspects of Communication Technology	3
COMM 518	Media Effects	3
COMM 520	Seminar in Advertising Problems	3
COMM 521	Advertising Perspectives	3
COMM 522	Social and Cultural Aspects of Advertising	3
COMM 550	Film Theory and Criticism	3
COMM 553	Special Problems in Film and TV	1-3
COMM 556	Reading Film	3
COMM 580	Seminar in Telecommunications	3
COMM 582	Ethics and Emerging Communications Technology	3
COMM 584	International Telecommunications and Trade Policy	3
COMM 585	Media & Telecommunications Industries	3
COMM 594	Research Topics	1-15
COMM 595	Internship	1-18
COMM 597	Special Topics	1-9
<i>Undergraduate Credits</i>		
<i>Advertising</i>		
COMM 410	International Mass Communications	3
COMM 411	Cultural Aspects of the Mass Media	3
COMM 417	Ethics and Regulation in Advertising and Public Relations	3
COMM 420	Research Methods in Advertising and Public Relations	3
COMM 421W	Advertising Creative Strategies	3

COMM 424	Advertising Campaigns	3
<i>Journalism</i>		
COMM 403	Law of Mass Communications	3
COMM 405	Political Economy of Communications	3
COMM 409	News Media Ethics	3
COMM 410	International Mass Communications	3
COMM 411	Cultural Aspects of the Mass Media	3
<i>Film Production</i>		
COMM 411	Cultural Aspects of the Mass Media	3
COMM 438	Advanced Narrative Production	3
COMM 440	Advanced Cinematography and Lighting Techniques	3
COMM 451	Topics in American Film	3
COMM 452	Topics in International Cinema	3
<i>Media Studies</i>		
COMM 405	Political Economy of Communications	3
COMM 411	Cultural Aspects of the Mass Media	3
COMM 413W	The Mass Media and the Public	3
COMM 418	Media Effects: Theory and Research	3
<i>Public Relations</i>		
COMM 403	Law of Mass Communications	3
COMM 409	News Media Ethics	3
COMM 417	Ethics and Regulation in Advertising and Public Relations	3
COMM 420	Research Methods in Advertising and Public Relations	3
COMM 471	Public Relations Media and Methods	3
<i>Telecommunications and Media Industries</i>		
COMM 403	Law of Mass Communications	3
COMM 405	Political Economy of Communications	3
COMM 410	International Mass Communications	3
COMM 484	Emerging Telecommunications Technologies	3
COMM 486W	Telecommunications Ethics	3
COMM 487W	Advanced Telecommunications Management and Leadership	3

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.A. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Joint Degrees

Joint J.D./M.A. with Penn State Law

Requirements listed here are in addition to requirements listed in GCAC-211 Joint Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-211-joint-degree-programs/>).

Admission Requirements

Students applying to the joint degree program must be admitted separately into both PSL and COMM. Admissions requirements and applications for admission for Penn State Law are listed in the J.D. Admissions section (<https://pennstatelaw.psu.edu/admissions/jd-admissions/application-requirements/>) of the Penn State Law website. The admission requirements for the Media Studies graduate program are listed on the Admission Requirements tab. Students must first be admitted to the law school and must complete the required first-year curriculum in the J.D. program before commencing the Media Studies M.A. component. Application to the M.A. program must take place through the Graduate School Application. Formal admission to the M.A. program would normally take place during the student’s first year of law, but COMM may extend admission to the M.A. program at the time an applicant applies to PSL particularly where an applicant’s law school choice depends upon admission to the J.D./M.A. joint degree program. At the student’s request, the LSAT may replace the GRE for joint degree admission purposes.

Residency: A typical J.D./M.A. joint degree student will be in residence at PSL for six semesters and at COMM for two semesters.

Liaisons: The department and faculty liaisons for PSL shall be the Associate Dean for Academic Affairs and the student adviser shall be the Associate Dean for Academic Affairs or such other faculty member(s) as may be designated by the Dean. The liaison for COMM shall be the Joint Degree J.D./M.A. Program Faculty Adviser.

Inter-Program Transfer of Credits

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the J.D. program are listed on the Penn State Law website. Degree requirements for the M.A. degree are listed on the Degree Requirements tab.

Penn State Law: A maximum of twelve (12) 500-level credits for Media Studies M.A. course work may be transferred for credit toward the J.D. degree at PSL. Students must obtain a grade satisfactory to PSL for the course work to be credited toward the J.D. degree. The following COMM courses may qualify for credit toward the PSL J.D.:

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
COMM 504	Seminar in the History of Mass Communication	3
COMM 505	International Communication Problems	3
COMM 506	Research Methods in Communications	3
COMM 511	Qualitative Research Methods in Mass Communications	3
COMM 513	Constitutional Problems of the News Media	3
COMM 516	Introduction to Data Analysis in Communications	3
COMM 517	Psychological Aspects of Communication Technology	3
COMM 518	Media Effects	3
COMM 580	Seminar in Telecommunications	3
COMM 582	Ethics and Emerging Communications Technology	3
COMM 585	Media & Telecommunications Industries	3
COMM 587	Internet Law and Policy	3

Donald P. Bellisario College of Communication: A maximum of twelve (12) credits of PSL course work will be counted for credit for the minimum requirements for a master’s degree. These courses must be approved

by the student’s advisory committee and Joint Degree Program Faculty Adviser in COMM, normally during the Program Proposal Meeting.

The J.D. seminar requirement and the Media Studies thesis requirement must be fulfilled separately, using unique research topics.

Course Sequencing: The sequence of courses will be determined by the student and their adviser(s). However, students must successfully complete the first-year curriculum with PSL before beginning the M.A. Media Studies program. In compliance with ABA Standards and Rules law students may not enroll for more than 17 credits per semester at Penn State as a law student; the maximum credit load for graduate students is 15 credits per semester. It is expected that most joint degree students will complete the first two semesters of the M.A. consecutively in either the first or second year after completion of the first-year curriculum with the Law School.

Recommended Program of Study and Advising

All students in the program will have two advisers, one from PSL and one from COMM; the adviser from COMM may be any member of the Graduate Faculty in the College. Periodic interaction between the two advisers is encouraged. A program of study is developed for each student, taking into account the fact that some courses at both locations are offered on a rotating or intermittent basis. Many courses are offered every year but some are offered every two or three years. Advisers will have available a list of projected relevant courses or educational experiences in order to work with the student on an individualized program of study. The standard committee structure will apply to the COMM M.A. program.

Tuition

Students will be charged the applicable PSL tuition to cover the J.D. program and the applicable graduate tuition to cover the M.A. degree program. PSL tuition will be paid for the semesters in which the student is registered for PSL courses, and graduate tuition will be paid for the semesters in which the student is registered for graduate courses in the M.A. program. A student may take up to one course (3 credit hours) per semester in the program where the student is not primarily registered without any change in tuition, but must pay additional tuition to the program that the student is not primarily registered if he or she wishes to take additional course work pursuant to that program during the semester.

Financial Aid and Assistantships

Decisions on financial aid and assistantships will be made by each school according to that school’s procedures. Students on graduate assistantships must adhere to the course load limits set by The Graduate School.

Fulfillment of Degree Requirements and Graduation

A student in the program may complete the requirements for one of the degrees and be awarded that degree prior to completing all the requirements for the other degree; provided, however, that the student shall have successfully completed at least two semesters of work towards the other degree. All courses in one program that will count towards meeting the requirements of the other must be completed before the awarding of either degree. Students will be required to fulfill all requirements for each degree in order to be awarded that degree, subject to the inter-program transfer of credits. If students accepted into the joint degree program are unable to complete the J.D. degree, they are still eligible to receive the M.A. degree if all M.A. degree requirements have been satisfied.

Important Note: If the joint degree student is using law (900-level) credits toward the graduate degree during their last semester of enrollment, they should be prepared to extend their graduate degree graduation to a subsequent semester (the following semester at a minimum). This is due to the graduate degree approval deadline falling before the law (900-level) course grading processes are complete.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Communications (COMM) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/comm/>)

Learning Outcomes

1. Students will be able to distinguish among the major perspectives, theoretical concepts, and professional associations of mass/mediated communications research.
2. Students will be able to design and complete an original research study in mass/mediated communications.

Contact

Campus	University Park
Graduate Program Head	Anthony Olorunnisola
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Anthony Olorunnisola
Program Contact	Anthony Olorunnisola 201 Carnegie Bldg. University Park PA 16802 axo8@psu.edu (814) 863-7997
Program Website	View (https://bellisario.psu.edu/graduate/)

Meteorology and Atmospheric Science

Graduate Program Head	Paul Markowski
Program Code	METEO
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Dual-Title Ph.D. in Meteorology and Atmospheric Science and Astrobiology Dual-Title Ph.D. in Meteorology and Atmospheric Science and Climate Science Integrated B.S. in Meteorology and Atmospheric Science and M.S. in Meteorology and Atmospheric Science
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=METEO)

The graduate program embraces topics that span atmospheric processes from those of the planetary boundary layer to those of the upper atmosphere, that encompass phenomena from weather to climate with molecular to planetary dimensions, and that range from practical to theoretical significance. The program develops and integrates approaches based on observational, computational and analytical techniques, and seeks to advance both fundamental understanding and predictive skill.

The major interests of the faculty and graduate students include (1) mesoscale and synoptic-scale weather systems; (2) climate and earth system dynamics; (3) atmospheric physics including radiative transfer and cloud physics; (4) atmospheric chemistry, air quality and the earth's biogeochemical cycles; (5) atmospheric turbulence, boundary layers, land-atmosphere interactions, ocean-atmosphere interactions, and ocean-ice-atmosphere interactions; (6) geophysical fluid dynamics, (7) physical oceanography, (8) climate and weather risk, and (9) space weather. Methodological approaches include numerical modeling, data assimilation, atmospheric remote sensing, field observations, atmospheric data analysis, and laboratory studies.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate->

admissions/how-to-apply/). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The Meteorology and Atmospheric Science program is open to all students with a baccalaureate degree and a strong interest in the atmospheric sciences. A degree in science (including, but not limited to, meteorology or atmospheric science), mathematics, or engineering provides a particularly good background, although the department has had some students with arts and humanities degrees who have done well. The minimum course requirements for admission are mathematics at least through differential equations and at least one year of calculus-based physics.

For admission to the program, the departmental admission committee considers courses taken, grade-point average, three letters of recommendation, professional experience, and English proficiency. Rather than setting rigid standards in each category, the committee examines the overall record as a whole. The best-qualified applicants are accepted up to the number of spaces that are available for new students.

Generally, additional mathematics and physics beyond the minimum requirements listed above, as well as courses in statistics, chemistry, and computer programming, will strengthen the student's application. Courses in meteorology and atmospheric science are not required for admission. Most students admitted to the graduate program have undergraduate grade-point averages of 3.50 or higher. Three recommendations are solicited from persons familiar with the student's academic competence, and the student is required to write a letter summarizing interests and goals.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Note: All international students required to take the English proficiency test must take the American English Oral Communicative Proficiency Test (AEOCPT) (<http://aplmg.la.psu.edu/programs/about-the-aocpt/about-the-american-english-oral-communicative-test-aocpt/>) upon first enrollment. If the student does not meet the minimum score requirements on the AEOCPT, the student must complete additional course work in English in order to be eligible to receive a teaching assistantship.

Degree Requirements

The program differentiates between instruction and research topics appropriate for M.S. students seeking positions of advanced responsibility in government or industry, those appropriate for M.S. students anticipating further study, and those appropriate for Ph.D. candidates who will work in advanced research laboratories or academic institutions.

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The M.S. degree is offered with thesis or research paper options, both requiring 35 credits.

A minimum of 35 credits at the 400, 500, 600, or 800 level is required, with at least 29 credits at the 500, 600 and 800 level combined. The required core curriculum consists of 23 credits, including 12 credits in four distinct courses, two each from two prescribed lists for dynamic meteorology and physical meteorology:

Code	Title	Credits
Required Courses		
<i>Dynamic Meteorology Courses</i>		
Select two courses from the following:		6
METEO 520	Geophysical Fluid Dynamics	
METEO 521	Dynamic Meteorology	
METEO 554	Atmospheric Turbulence	
METEO 551	Physical Oceanography	
METEO 570	Climate System Dynamics	
<i>Physical Meteorology Courses</i>		
Select two courses from the following:		6
METEO 532	Chemistry of the Atmosphere	
METEO 533	Cloud Physics	
METEO 535	Radiative Transfer	
METEO 556	The Atmospheric Boundary Layer	
METEO 570	Climate System Dynamics	
<i>Additional Required Courses</i>		
METEO 880	Communication of Research in Atmospheric Science	2
	or METEO 596 Individual Studies	
METEO 590	Colloquium	2
METEO 591	Development and Ethics in the Atmospheric Sciences	1
6 elective credits from 500-level Meteorology and Atmospheric Science courses or 500-level courses in related disciplines from a list of approved electives maintained by the program office		6
Total Credits		23

Students can choose to complete either a thesis or a scholarly paper as the culminating experience for the degree. Students who choose the thesis track must select METEO 880 and 6 additional elective credits from 400- and 500-level course work in Meteorology and Atmospheric Science or related disciplines from a list of approved electives maintained by the program office. In addition, students must complete 6 quality-graded credits in thesis research (METEO 600 or METEO 610) in conjunction with completing the thesis (quality-graded credits count toward the grade-point average). The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School, and the student must pass a thesis defense.

Students in the scholarly paper track must select 2 credits of METEO 596, 6 additional elective credits from 400- and 500-level course work in Meteorology and Atmospheric Science, and 6 additional credits from 400- and 500-level course work in Meteorology and Atmospheric Science or related disciplines from a list of approved electives maintained by the program office. Students in the scholarly paper track cannot count METEO 600 credits towards degree requirements. Students will complete the scholarly paper while registered for 2 credits of METEO 596 in their final semester. M.S. students in the scholarly paper track must defend their scholarly paper in a public presentation that is evaluated by, and must be approved by, the students' committee.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Studies for the Ph.D. degree are designed to accommodate the interests and capabilities of the student, and they are overseen by a Ph.D. committee, which also administers comprehensive and final oral examinations. The student must have the academic support of a faculty member and the student must pass the Ph.D. qualifying examination. The exam must be taken within three semesters (excluding summer sessions) of entry into the doctoral program. If a student does not pass the exam on their first attempt, then a second attempt may be allowed at the discretion of the Graduate Faculty members of the department.

In addition, Ph.D. degree requirements include successful completion of the following: approved graduate course work, English competence requirements, a comprehensive examination, and a final oral examination (the dissertation defense). The student must pass the English competency exam before scheduling the comprehensive exam. To earn the Ph.D. degree, doctoral candidates must write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School. For the Ph.D. program, a minimum of 21 credits is required, including a core curriculum of 12 credits in four distinct courses, two each from two prescribed lists for dynamic meteorology and physical meteorology. The student will be tested for mastery of the selected core in the qualifying exam.

Code	Title	Credits
Required Courses		
<i>Dynamic Meteorology Courses</i>		
Select two courses from the following:		6
METEO 520	Geophysical Fluid Dynamics	
METEO 521	Dynamic Meteorology	
METEO 554	Atmospheric Turbulence	
METEO 551	Physical Oceanography	
METEO 570	Climate System Dynamics	
<i>Physical Meteorology Courses</i>		
Select two courses from the following:		6
METEO 532	Chemistry of the Atmosphere	
METEO 533	Cloud Physics	
METEO 535	Radiative Transfer	
METEO 556	The Atmospheric Boundary Layer	
METEO 570	Climate System Dynamics	
METEO 591	Development and Ethics in the Atmospheric Sciences ¹	1
METEO 880	Communication of Research in Atmospheric Science ²	2
Electives		
A minimum of 6 elective credits from METEO 500-level or related discipline 400- or 500-level courses must be taken that do not count toward any other degree requirement and finished by the semester in which the comprehensive exam is passed.		6
Total Credits		21

¹ Students must take METEO 591 the first semester it is available upon matriculating in the program.

² METEO 880 must be taken prior to the department's competency exam in written and spoken technical English.

³ One credit of METEO 590 is required each semester until the comprehensive exam is passed.

The 12 credits of core curriculum courses, METEO 880, and METEO 591 may be waived as required courses at the discretion of the program if the student has already taken them or equivalent courses, and the total required credits will be reduced accordingly. In addition to the 21 minimum required credits, one credit of METEO 590 is required each semester until the comprehensive exam is passed. A student must pass the department's competency exam in written and spoken technical English before being admitted to the comprehensive exam. There are no minimum quality-graded credit (research credits whose grades count toward the grade-point average) requirements for METEO 600; students may earn up to a maximum of 12 quality-graded METEO 600 credits.

Minor Master's Minor

Requirements listed here are in addition to requirements for minors in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

For a master's minor in Meteorology and Atmospheric Science, a student must select 6 credits of Meteorology and Atmospheric Science courses, 3 of which have to be at the 500-level, in a course plan approved by the Meteorology and Atmospheric Science graduate program.

Doctoral Minor

Requirements listed here are in addition to requirements for minors in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

For a minor in Meteorology and Atmospheric Science, doctoral students should select 15 credits of Meteorology and Atmospheric Science courses, 9 credits of which have to be 500-level, in a course plan approved by the department.

Dual-Titles

Dual-Title Ph.D. in Meteorology and Atmospheric Science and Astrobiology

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Students interested in the emerging field of Astrobiology may wish to obtain a dual-title Ph.D. in Meteorology and Atmospheric Science and Astrobiology. The pursuit of this dual-title entails additional course work beyond the degree requirements set forth here (see the Astrobiology Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/astrobiology/>) for further details concerning these course and other program requirements), as well as the participation of at least one Astrobiology program faculty member on the Ph.D. committee. The Astrobiology representative, who assists with the selection of courses, may be the adviser and have an appointment in Meteorology and

Atmospheric Science. The field of Astrobiology will be integrated into the comprehensive examination. A Ph.D. dissertation that contributes fundamentally to the field of Astrobiology is required. A public oral presentation of the dissertation is required.

Admission Requirements

Students must apply and be admitted to the graduate program in Meteorology and Atmospheric Science and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Astrobiology dual-title program. Refer to the Admission Requirements section of the Astrobiology Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/astrobiology/>). Doctoral students must be admitted into the dual-title degree program in Astrobiology no later than the end of the fourth semester (not counting summer semesters) of entry into the graduate major program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the Ph.D. in Meteorology and Atmospheric Science. In addition, students must complete the degree requirements for the dual-title in Astrobiology, listed on the Astrobiology Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/astrobiology/>).

The Qualifying Examination in the major area alone will satisfy the Qualifying Exam requirement for the dual-title program.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Meteorology and Atmospheric Science and Astrobiology dual-title Ph.D. student must include at least one member of the Astrobiology Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Astrobiology, the member of the committee representing Astrobiology must be appointed as co-chair. The Astrobiology representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Meteorology and Atmospheric Science and Astrobiology. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title Ph.D. in Meteorology and Atmospheric Science and Climate Science

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Students interested in the field of Climate Science may wish to obtain a dual-title Ph.D. in Climate Science and Meteorology and Atmospheric Science. The pursuit of this dual-title entails additional course work beyond the degree requirements set forth here (see the Climate Science Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/>

[climate-science/](http://bulletins.psu.edu/graduate/programs/majors/astrobiology/)) for further details concerning these course and other program requirements), as well as the participation of at least one Climate Science program faculty member on the Ph.D. committee. The Climate Science representative, who assists with the selection of courses, may be the adviser and have an appointment in Meteorology and Atmospheric Science. The field of Climate Science will be integrated into the comprehensive examination. A Ph.D. dissertation that contributes fundamentally to the field of Climate Science is required. A public oral presentation of the dissertation is required.

Admission Requirements

Students must apply and be admitted to the graduate program in Meteorology and Atmospheric Science and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Climate Science dual-title program. Refer to the Admission Requirements section of the Climate Science Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/climate-science/>). Doctoral students must be admitted into the dual-title degree program in Climate Science no later than the end of the fourth semester (not counting summer semesters) of entry into the primary Ph.D. program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the Ph.D. in Meteorology and Atmospheric Science. In addition, students must complete the degree requirements for the dual-title in Climate Science, listed on the Climate Science Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/climate-science/>).

The qualifying examination in Meteorology and Atmospheric Science satisfies the qualifying exam requirement for the dual-title degree program in Climate Science.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Meteorology and Atmospheric Science and Climate Science dual-title Ph.D. student must include at least one member of the Climate Science Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Climate Science, the member of the committee representing Climate Science must be appointed as co-chair. The Climate Science representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Meteorology and Atmospheric Science and Climate Science. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Integrated Undergrad-Grad Programs

Integrated B.S. in Meteorology and Atmospheric Science and M.S. in Meteorology and Atmospheric Science

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Meteorology and Atmospheric Science with

the M.S. in Meteorology and Atmospheric Science offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- University Park

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The Department of Meteorology and Atmospheric Science offers an integrated B.S./M.S. program, also called the Integrated Undergraduate-Graduate (IUG) program, that is designed to allow academically superior students to obtain both the B.S. and the M.S. degree in Meteorology and Atmospheric Science in five years of study. In order to complete the program in five years, students interested in the IUG program in Meteorology and Atmospheric Science must apply for admission to the Graduate School and the IUG program no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree.

During the first three years, the student will follow the course scheduling of one of the options in the B.S. degree, normally the Atmospheric Sciences or the General Option (see the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>)). Students who intend to enter the IUG program are encouraged to take upper level classes during their first three years whenever appropriate. However, students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. By the end of the junior year, students normally apply for admission to both the IUG Program and to the Graduate School. Acceptance decisions will be made prior to the beginning of the senior year and M.S. advising committees appointed for successful applicants. During the senior year, IUG students follow the scheduling of the selected B.S. Meteorology and Atmospheric Science Option, with an emphasis on completing 500-level course work as appropriate. During the senior year, IUG students will start work on their theses or papers that are designed to meet the requirements of the M.S. degree in Meteorology and Atmospheric Science. During the fifth year, IUG students take courses fulfilling the departmental M.S. degree requirements and complete their M.S. theses or papers. Typical scheduling plans for students pursuing the General or Atmospheric Sciences Options are given on the Meteorology and Atmospheric Science Undergraduate Bulletin page (<http://undergraduate.bulletins.psu.edu/undergraduate/colleges/earth-mineral-sciences/meteorology-atmospheric-science-bs/>). If a plan similar to one of these plans is followed, then the student will have completed all requirements for the B.S. in Meteorology and Atmospheric Science by the end of the fourth year. If a student cannot continue in the integrated program, then the student will be able to receive the undergraduate degree upon completion of all of the B.S. requirements.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to

Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students must apply to the program via the Graduate School application for admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet all the admission requirements of the Graduate School and the Meteorology and Atmospheric Science graduate program for the Master of Science degree. In consultation with an adviser, students must prepare a plan of study appropriate to this integrated program, and must present their plan of study to the head of the graduate program or the appropriate committee overseeing the integrated program prior to being admitted to the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.

Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. Admission to the program will be at the discretion of the Associate Head of the Department of Meteorology and Atmospheric Science graduate program, who will determine the necessary criteria for all applicants. These criteria include the setting of the minimum required scores on the GRE and minimum cumulative GPA for consideration, the receipt of recommendation letters from three faculty and a letter of support from the department head, and the identification of an adviser who is willing to oversee the student's research project. Evidence of significant research potential must be provided in the application.

Degree Requirements

Students must fulfill all degree requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Science in Meteorology and Atmospheric Science are listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/undergraduate/>). Degree requirements for the Master of Science in Meteorology and Atmospheric Science are listed on the Degree Requirements tab. All IUG students must defend their theses or papers, as do all M.S. students, in a public presentation toward the end of their graduate program.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
METEO 520	Geophysical Fluid Dynamics	3
METEO 521	Dynamic Meteorology	3
METEO 532	Chemistry of the Atmosphere	3
METEO 533	Cloud Physics	3
METEO 535	Radiative Transfer	3
METEO 554	Atmospheric Turbulence	3
METEO 551	Physical Oceanography	3
METEO 556	The Atmospheric Boundary Layer	3
METEO 570	Climate System Dynamics	3

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement.

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Most graduate students are supported with teaching or research assistantships.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Meteorology (METEO) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/meteo/>)

Learning Outcomes

MAster of Science (M.S.)

1. Know: Graduates will acquire and demonstrate mastery of knowledge within a core disciplinary area of the atmospheric sciences while demonstrating familiarity with other topics within the atmospheric sciences outside of the core area.
2. Investigate: Graduates will develop analytical and methodological skills necessary to apply knowledge of the atmospheric sciences to the solution of an unanswered problem within the discipline.
3. Communicate: Graduates will disseminate results of investigation via a logically, clearly written master's thesis, and via articulate, effective presentations.
4. Professional practice: Graduates will demonstrate the ability to collaborate in a collegial and ethical manner with other professionals within their field or with diverse scientific backgrounds.

Doctor of Philosophy (Ph.D.)

1. Know: Graduates will demonstrate in-depth knowledge within a core disciplinary area of atmospheric science while extending their depth of knowledge on other topical areas within the atmospheric sciences.
2. Investigate: Graduates will master analytical and methodological skills necessary to pursue solutions to unanswered problems within the atmospheric sciences independently.
3. Communicate: Graduates will disseminate research results of investigations through a logically, clearly written doctoral thesis, and through articulate, effective presentations.

4. Professional practice: Graduates will demonstrate the ability to collaborate in a collegial and ethical manner with other professionals in their field or with diverse scientific backgrounds.

Contact

Campus	University Park
Graduate Program Head	Paul Markowski
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Jerry Y Harrington
Program Contact	Karen Corl 501A Walker Building University Park PA 16802 kqc8@psu.edu (814) 863-9500
Program Website	View (http://www.met.psu.edu/future-graduate-students-ms-and-phd/)

Microbiome Sciences

Graduate Program Head	Carolee Bull
Program Code	MBIOM
Campus(es)	University Park
Degrees Conferred	Dual-Title
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=MBIOM)

Students electing this degree program through participating programs earn a degree with a Dual Title in the Ph.D., e.g., Ph.D. in (graduate program name) and Microbiome Sciences.

The following graduate program offers a dual-title in Microbiome Sciences: Plant Pathology.

The Microbiome Sciences Dual-Title Degree Program will be administered by the Department of Plant Pathology and Environmental Microbiology for the participating graduate programs. An executive committee with representatives from participating departments will maintain program definition, identify courses appropriate to the program, and recommend policy and procedures for the program's operation to the dean of the Graduate School and to the deans of the participating colleges.

Admission Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

For admission to pursue a dual-title degree under this program, a student must apply to (1) the Graduate School and (2) one of the participating major graduate programs; and then subsequently to (3) the Microbiome Sciences program through the program head. Students may only apply to the dual-title program once they have been enrolled in a major program. Once a student has been enrolled in a major program, application to the dual-title degree program can occur immediately or at any time before the end of the fourth semester, not counting summer terms. The application for the dual-title degree program may be completed after the qualifying examination in the major program, as long as the application takes place before the end of the fourth semester. Graduate students

with research and educational interests in Microbiome Sciences may apply to the Microbiome Sciences Dual-Title Degree Program. Candidates must submit to the program head transcripts of their undergraduate and graduate coursework, a written personal statement indicating their interests in the interdisciplinary arena of Microbiome Sciences and the career goals they hope to work toward by attaining a Microbiome Sciences dual-title. Their dissertation adviser, if assigned, must also be provided. A strong undergraduate preparation in the basic sciences is expected, with evidence of an interest in multiple disciplines.

Degree Requirements

To qualify for a dual-title degree, students must satisfy the requirements of the major graduate program in which they are enrolled, in addition to the minimum requirements of the Microbiome Sciences program.

Students are required to have two advisers from separate disciplines: one individual serving as a primary adviser in their major degree program and a secondary adviser in an area within a field covered by the Dual-Title program and a member of the Microbiome Sciences faculty.

The major program adviser normally will also be a member of the Microbiome Sciences faculty. The two faculty advisers can represent different academic programs, but this is not required, as faculty from a scientifically diverse department could represent very different areas of expertise.

To fulfill the course requirements for the dual-title in Microbiome Sciences, students must complete a total of 15 credits including 2 credits of ECLGY 550 and at least 13 credits chosen in consultation with the adviser from an approved list of courses, with at least 3 credits in each of the following areas: microbial sciences, ecology and evolution, and bioinformatics and research tools. All students must pass a qualifying examination in their major field of study. The qualifying examination for the student's graduate major program will satisfy the qualifying examination for the dual-title degree program in Microbiome Sciences. The qualifying examination for the major program must take place before the end of the fourth semester to enable enrollment in the dual-title Microbiome Sciences program by that time. The qualifying examination committee will be composed of Graduate Faculty from the major program and may include, but is not required to include, a faculty member who holds appointments in both programs' Graduate Faculty.

In addition to the general Graduate Council requirements for Ph.D. committees, the student's Ph.D. committee must include Graduate Faculty from the major program and must also include at least one member of the Microbiome Sciences Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Microbiome Sciences, the member of the committee representing Microbiome Sciences must be appointed as a co-chair. The Microbiome Sciences representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

A Ph.D. dissertation that contributes fundamentally to the field of Microbiome Sciences is required. A public oral presentation of the dissertation is required, which may be part of the final defense within the major degree program. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree

Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Dual-title graduates will have an understanding of microbiome diversity, dynamics, and measurement methods which will qualify them for positions in academia, government agencies, or industry.
2. Dual-title graduates will have laboratory and computer skills for characterizing the composition and function of microbiomes and be able to relate microbiome characteristics to relevant information from associated hosts and ecosystems (metadata).
3. Dual-title graduates will generate meaningful hypotheses and interpret data in ways that lead to solution of novel problems in microbiome sciences.
4. Dual-title graduates will recognize the means for pursuing diverse career opportunities and articulate professional and ethical issues in the field of microbiome sciences.

Contact

Campus	University Park
Graduate Program Head	Carolee Bull
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Mary Ann Victoria Bruns
Program Contact	

Molecular, Cellular and Integrative Biosciences

Graduate Program Head	Melissa Rolls
Program Code	MCIBS
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Joint M.D./Ph.D. with the College of Medicine
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=MCIBS)

The Intercollege Graduate Degree Program (IGDP) in Molecular, Cellular, and Integrative Biosciences (MCIBS) is designed to prepare researchers across an array of specializations in the biological sciences that share an emphasis on trans-disciplinary training, an approach that considers the whole organism and spans the continuum of understanding from fundamental mechanisms of action at the molecular/cellular level of discovery, to the function of the organism in its environment, with applications that enhance health and well-being. To achieve this goal, the IGDP in MCIBS serves as an umbrella portal for the entry and subsequent training of the next generation of researchers for academic, industrial, non-profit foundation, government, and other research entities in the biomedical sciences. Researchers will be trained across a wide range of specializations in the biological sciences that share the goal to elucidate mechanisms of action at the molecular, cellular, and organismal level, including disease.

The program currently offers educational and research emphasis areas in Cancer Biology; Cell and Developmental Biology; Immunology and Infectious Disease; Molecular and Evolutionary Genetics; Molecular Toxicology; and Neurobiology, but is structured to remain contemporary with evolving or emerging fields within the biological/health sciences. Incoming students enroll in core courses of instruction covering basic biochemistry and molecular biology of cellular processes; ethics; and current research topics related to the diverse pathological mechanisms that underlie disease etiologies in humans and animals. In addition, students take specialized courses associated with one of the above programmatic emphasis areas or the option, as well as elective courses that complement and support their research interests and foci.

Calling upon the expertise of an extensive list of life science research faculty members representing an array of different departments across multiple colleges, the IGDP in MCIBS offers a unique opportunity to learn about and work in multiple bioscience disciplines. The MCIBS graduate program is supported by modern telecommunications facilities and equipment, and students not only explore new conceptual connections at the frontiers of research, but also engage in active group learning experiences and explore a variety of potential career opportunities before graduation.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Review of completed applications begins December 1 of each year. Applicants to the Ph.D. program are considered for admission; the program does not admit applicants for the terminal master's degree. GRE scores are not required for admission.

Required application materials include:

1. Completed official Penn State Graduate School application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>).
2. Paid, nonrefundable application fee (see Requirements for Graduate Admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>) for current fee).
3. Official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>).
4. Application for a U.S. visa (international applicants only).
5. Names and contact information, including business email addresses, for three references.
6. Statement of goals that pertain to the life sciences including motivation for pursuing a research doctorate; research experience and interests; and professional goals. The statement should include biological problems that are of interest to the applicant and how the applicant's past experiences have prepared him or her to pursue this research.
7. Successful applicants generally will have completed coursework in biochemistry, molecular and/or cell biology, physics, chemistry (organic and inorganic), and calculus and have a minimum 3.5/4.0 Jr./Sr. undergraduate grade point average.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Applicants to the MCIBS graduate program must have a minimum TOEFL score of 575 for the paper-based test, or a total score of 90 with a 21 on the speaking section for the Internet-based test (iBT). Successful applicants generally have a minimum score of 100 (with a 23 on the speaking section) on the Internet-based test.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Master's students must take a minimum of 31 credits, described below. At least 18 credits in 500- and 600-level courses combined must be included in the program. A minimum of 24 credits in course work (400, 500, and 800 series), as contrasted with research, must be completed in the major program.

Code	Title	Credits
Required Courses		
MCIBS 590	Colloquium	2
MCIBS 591	Ethics, Rigor, Reproducibility and Conduct of Research in the Life Sciences	2

BIOL 893	Experiential Teaching in Biology	2
MCIBS 596	Individual Studies (for Research Rotations)	1
MCIBS/BIOL/ BMMB/VBSC 503	Critical Elements of Genetics and Molecular and Cellular Biology	4
MCIBS 592	Current Research Seminar	2
Emphasis Areas		
MCIBS offers curricular/research specializations in the following Emphasis Areas: Cell and Developmental Biology; Immunology and Infectious Disease; Molecular and Evolutionary Genetics; Molecular Medicine; Molecular Toxicology; Neurobiology. To complete an emphasis in any of these areas, students take a minimum of 9 credits of specialized course work and conduct original research associated with the respective Emphasis Area. The list of specialized courses that will count towards each Emphasis Area is maintained by the program office.		9
Additional Course Requirements		
Quantitative Foundation Course: A minimum of 3 credits in 400- or 500-level courses in a quantitative area such as statistics, genetics, bioinformatics, etc. (e.g., STAT 501 Regression Methods; STAT 502 Analysis of Variance and Design of Experiments; STAT 503 Design of Experiments; Population Genetics; etc.). The list of courses that will count towards the Quantitative Foundation requirement is maintained by the program office.		3
Culminating Experience		
MCIBS 600	Thesis Research	6
Total Credits		31

In addition, all graduate students in MCIBS are required to have one semester of teaching experience by serving as a teaching assistant (TA) in an undergraduate course (400-level or lower) in a bioscience-related field. Teaching assistant opportunities are arranged in consultation with the adviser and program chair.

Master's students must complete at least 6 credits of MCIBS 600, and up to 6 of the MCIBS 600 credits may be assigned a quality grade (A-F). In consultation with the adviser, the student must select a thesis committee of at least three members (including the adviser), write a thesis, and defend the thesis. The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School, and the student must pass the thesis defense. If all course credits and requirements are met, a student does not have to be registered for classes while writing and/or defending the thesis. Students must present their thesis in accordance with Graduate Council and Graduate School guidelines as described in the Thesis and Dissertation Guide: Requirements and Guidelines for the Preparation of Master's Theses and Doctoral Dissertations (<https://gradschool.psu.edu/graduate-program-resources/faculty-and-staff/>). (<https://gradschool.psu.edu/completing-your-degree/thesis-and-dissertation-information/thesis-and-dissertation-guide/>)

Additional Requirements

All MCIBS graduate students must maintain a cumulative grade-point average of > 3.0 to remain in good academic standing. One or more failing grades (F) or a cumulative grade-point average below 3.0 will be considered evidence of unsatisfactory scholarship and may be grounds for dismissal from the program.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Ph.D. students must take a minimum of 25 credits, as described below. At least 18 credits in 500- and 600-level courses combined must be included in the program. A minimum of 24 credits in course work (400, 500, and 800 series), as contrasted with MCIBS 600, must be completed in the major program. A student's dissertation committee can require additional course work depending on the student's background and research plans.

Code	Title	Credits
Required Courses		
MCIBS 590	Colloquium	2
MCIBS 591	Ethics, Rigor, Reproducibility and Conduct of Research in the Life Sciences	2
BIOL 893	Experiential Teaching in Biology	2
MCIBS 596	Individual Studies (for Research Rotations)	1
MCIBS/BIOL/ BMMB/VBSC 503	Critical Elements of Genetics and Molecular and Cellular Biology	4
MCIBS 592	Current Research Seminar	2
Emphasis Areas		
MCIBS offers curricular/research specializations in the following Emphasis Areas: Cell and Developmental Biology; Immunology and Infectious Disease; Molecular and Evolutionary Genetics; Molecular Medicine; Molecular Toxicology; Neurobiology. To complete an emphasis in any of these areas, students take a minimum of 9 credits of specialized course work and conduct original research associated with the respective Emphasis Area. The list of specialized courses that will count towards each Emphasis Area is maintained by the program office.		9
Additional Course Requirements		
Quantitative Foundation Course: A minimum of 3 credits in 400- or 500-level courses in a quantitative area such as statistics, genetics, bioinformatics, etc. (e.g., STAT 501 Regression Methods; STAT 502 Analysis of Variance and Design of Experiments; STAT 503 Design of Experiments; Population Genetics; etc.). The list of courses that will count towards the Quantitative Foundation requirement is maintained by the program office.		3
Total Credits		25

Teaching Experience

In addition, all graduate students in MCIBS are required to have one semester of teaching experience by serving as a teaching assistant (TA) in an undergraduate course (400-level or lower) in a bioscience-related field. Teaching assistant opportunities are arranged in consultation with the adviser and program chair.

English Competence

Doctoral degree students are required to demonstrate high-level competence in the use of the English language, including reading, writing, and speaking, as part of the language and communication requirements for the doctorate. This will be assessed for both domestic and international students as part of the qualifying exam, which includes a reading and original writing component. Should deficiencies be identified at the qualifying examination, students will be directed into appropriate remedial activities, including additional English and communication courses. Competence must be formally attested by the program before the doctoral student's comprehensive examination is

scheduled. (Note: Passage of the minimal TOEFL or IELTS requirement does not demonstrate the level of competence expected of a doctoral degree candidate and for conferral of a doctorate from Penn State.)

Qualifying Exam

All Ph.D. students in the IGDP in MCIBS must take a qualifying exam no later than the fall semester of the second year. The purpose of the exam is to ensure that students have mastered the core concepts necessary to proceed further towards the Ph.D. The exam consists of both written and oral components, and is based primarily on the students' ability to critically read, understand, and communicate the key findings of a current research paper selected from the literature.

Dissertation Committee

Upon successful completion of the qualifying examination, the student in consultation with his/her adviser will, as soon as possible, select a dissertation committee. The committee must meet Graduate Council guidelines for the composition of dissertation committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>). This committee is responsible for supervising the academic program and monitoring the progress of the student towards his/her degree. It is the charge of this committee to assure that the student carries out a substantial piece of independent research and presents it as a dissertation.

Comprehensive Examination

The Comprehensive Examination is administered and evaluated by the entire dissertation committee when the student has completed substantially all required course work, and is intended to determine the feasibility of the student's proposed research and the preparedness of the student to embark on his/her dissertation research. Students must be registered for classes (typically MCIBS 600) the semester they take this exam. The examination will consist of a written research proposal using an NRSA or NSF format, based upon the student's proposed dissertation research, and an oral presentation of the proposed research. The proposal must include a timeline for the completion of the work that will be considered in the feasibility of the work.

Dissertation

All Ph.D. candidates must conduct original research and prepare a dissertation that makes a significant contribution of new knowledge, is presented in a scholarly manner, and demonstrates an ability on the part of the candidate to do independent research of high quality. The contents and conclusions of the dissertation must be defended at the time of the final oral examination. The dissertation must be accepted by the dissertation committee, the head of the graduate program, and the Graduate School, and the student must pass a final oral examination (the dissertation defense).

Students must present their dissertation in accordance with Graduate Council and Graduate School guidelines as described in the Thesis and Dissertation Guide: Requirements and Guidelines for the Preparation of Master's Theses and Doctoral Dissertations (<https://gradschool.psu.edu/graduate-program-resources/faculty-and-staff/>).

Final Oral Examination

The final examination of the doctoral candidate is an oral examination administered and evaluated by the entire dissertation committee. It consists of an oral presentation of the dissertation by the candidate and a period of questions and responses. These will relate in large part to the dissertation, but may cover the candidate's entire program of study, because a major purpose of the examination is also to assess the general scholarly attainments of the candidate. The portion of the examination in

which the dissertation is presented is open to the University community and the public; therefore, it is expected that the examination will take place at University Park or the Hershey campus.

Additional Requirements

All MCIBS graduate students must maintain a cumulative grade-point average of > 3.0 to remain in good academic standing. Furthermore, a Ph.D. student must have a 3.0 GPA to take the doctoral qualifying, comprehensive, and final oral examinations. One or more failing grades (F) or a cumulative grade-point average below 3.0 will be considered evidence of unsatisfactory scholarship and may be grounds for dismissal from the program.

Joint Degrees

Joint M.D./Ph.D. with the College of Medicine

Requirements listed here are in addition to requirements listed in GCAC-211 Joint Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-211-joint-degree-programs/>).

Admission Requirements

Students interested in simultaneously pursuing an M.D. and Ph.D. degree must apply to the College of Medicine M.D. program using the national American Medical College Application Service (AMCAS) application system and indicate their intent to pursue the joint degree program. Admissions requirements and applications for admission for Penn State College of Medicine are available in the M.D. Program (<http://med.psu.edu/md/>) section of the Penn State College of Medicine website. The College of Medicine M.D./Ph.D. Admissions Committee reviews applications and evaluates applicants for acceptance into both the M.D. and Ph.D. program. Students not accepted into the joint degree program can be referred to either the M.D. or Ph.D. program, depending on their qualifications and interests.

After the review committee has accepted an applicant to the joint degree program, s/he must apply and be admitted to the Graduate School (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>) for admission to the graduate program. The general admission requirements for the Ph.D. degree are listed on the Admission Requirements tab. Additional admission requirements for the joint degree are listed below:

- Academic Achievement - Applicants to our program generally have very strong grades and MCAT scores. In recent years, successful applicants have an average GPA of 3.75 and MCAT scores of 33-34. Applicants are not required to take the GREs.
- Research Experience - We are especially interested in students with a strong and sustained background in research. Students who have spent 1-2 years after graduation conducting research are strongly encouraged to apply. Alternatively, in-depth research experience as an undergraduate can suffice.
- Recommendations - We are especially interested in receiving letters of recommendation from faculty with whom you conducted research and who can comment on your passion and potential for research.
- Goals - Applicants must be able to clearly articulate the reasons for pursuing the joint degree.
- International Students - All qualified students are eligible to apply regardless of citizenship.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the M.D. program are listed on the M.D.

Program (<http://med.psu.edu/md/>) section of the Penn State College of Medicine website. Degree requirements for the Ph.D. degree are listed on the Degree Requirements tab.

During the first two years of medical school, the student conducts at least three research rotations. After successful completion of the first two years of medical school the candidate joins their dissertation lab in the MCIBS Graduate Program.

During the summer after the second year of medical school M.D./Ph.D. students take Step 1 of the United States Medical Licensing Examination (USMLE), which serves in lieu of the knowledge-based part of the qualifying examination for the MCIBS program. Successful completion of BMS 506A and BMS 506B, which is taken in the second year of medical school, with a grade of B or higher, meets the critical thinking and paper analysis requirement of the qualifying exam.

The Ph.D. committee of an M.D./Ph.D. student in the MCIBS program is formed upon entry into the dissertation laboratory. In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the committee must include at least two members of the MCIBS program Graduate Faculty and one M.D./Ph.D. steering committee member.

The MCIBS program will accept passing grades in the medical school courses SPM 711 (15 cr.) in lieu of 11 required credits for the MCIBS Core Required and Elective courses. The 11 required credits include:

Code	Title	Credits
Required Courses		
MCIBS 503	Critical Elements of Genetics and Molecular and Cellular Biology	4
MCIBS 596	Individual Studies	1
Electives		
BMMB 541	Molecular Biology of Animal Development	3
BMMB 542	Eukaryotic Cell Biology	3
Total Credits		11

Because students in the M.D./Ph.D. program are being trained to combine research and medicine, most likely in medical schools, the MCIBS requirement for exposure to undergraduate teaching is waived. M.D./Ph.D. candidates are not required to take BIOL 593 (2 credits) or to be teaching assistants. The Emphasis Area requirement and the Quantitative Foundation Course requirement are also waived.

In addition to taking the required courses MCIBS 590 (2 cr.), MCIBS 591 (1 cr.), and MCIBS 592 (2 cr.), elective courses are selected in consultation with the student's dissertation adviser and Ph.D. committee, with guidance from the MCIBS emphasis area course lists and program chair. 6 credits of elective courses will be selected.

The M.D./Ph.D. candidate prepares a written comprehensive examination in the format of a grant application and gives an oral presentation of this proposal to their Ph.D. committee.

A dissertation must be prepared and defended by each M.D./Ph.D. candidate, as described on the Degree Requirements tab. In addition, M.D./Ph.D. students must have *submitted* a first-author manuscript before defending their dissertation. Before returning to medical school, the doctoral dissertation must be accepted by the Graduate School.

The M.D./Ph.D. program requires that students have one first author peer-reviewed paper published based on their research accepted prior to completing medical school, and preferably accepted for publication prior to returning to the third year of medical school. At the discretion of the College of Medicine Vice Dean for Research and Graduate Studies, in consultation with the MCIBS Program Chair, the requirement for a first author publication prior to completing medical school may be waived. Examples of conditions that might warrant exemptions include:

- prolonged illness,
- mentor's relocation,
- mentor's reluctance to submit the student's work for publication,
- the student's project is published by another research group, or
- delays or challenges in the publication review process beyond the control of the student or dissertation adviser.

If a student decides not to return to medical school, or for some other reason is not able to complete the last two years of medical school, but they have successfully completed their Ph.D. dissertation and final oral examination and met all other degree requirements for the Ph.D. in MCIBS, they will be eligible to receive the Ph.D. The latter will be conferred after the student notifies the program that she/he wishes to withdraw from the M.D. program and completes all requirements for conferral of the Ph.D. degree.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by

graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Molecular, Cellular, and Integrative Biosciences (MCIBS) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/mcibs/>)

Learning Outcomes

Doctor of Philosophy (Ph.D.)

1. **Know:** demonstrate knowledge of core principles and primary literature in their specialty area including comprehension of methods, results, and data analysis in the specialty area.
2. **Apply/Create:** demonstrate ability to design and carry out a major research project in the field, including synthesis of previous work in the field, and assembling new findings into a written work that advances understanding in the field.
3. **Think:** demonstrate ability to critically analyze work by others in their specialty area.
4. **Communicate:** demonstrate ability to convey scientific ideas and results in clear, concise and original writing as well as in formal oral presentations.
5. **Professional Practice:** demonstrate comprehension of and commitment to ethical standards in the discipline. Demonstrate the ability to teach key concepts.
6. **Teach:** demonstrate the ability to teach key concepts of the discipline to students.

Contact

Campus	University Park
Graduate Program Head	Melissa Rolls
Program Contact	Freya Heryla 101 Life Sciences Building University Park PA 16802 fqh5144@psu.edu (814) 863-3273
Program Website	View (https://www.huck.psu.edu/graduate-programs/molecular-cellular-and-integrative-biosciences/)

Music

Graduate Program Head	Ann Marie Stanley
Program Code	MUCND, MUCOM, MUPER, MUSMA, MUSPP
Campus(es)	University Park
Degrees Conferred	Master of Arts (M.A.) Master of Music (M.Mus.) Integrated B.A. in Music and M.A. in Music Integrated B.M. in Performance and M.A. in Music
The Graduate Faculty	Music (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=MUSMA) Music, Composition and Theory (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=MUCOM) Music, Conducting (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=MUCND) Music, Performance and Pedagogy (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=MUSPP) Music, Performance (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=MUPER)

The School of Music is an accredited institutional member of the National Association of Schools of Music.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The School of Music requires the completion of a recognized baccalaureate degree in music or music education, with a junior/senior grade-point average of 2.80 or higher (on a 4.00 scale).

Admission to the M.Mus. program requires an audition, or the submission of compositions, or a list of works studied in preparation for conducting (depending on the specific degree).

Admission to the M.A. program requires evidence of scholarly writing on a musical topic.

Additional requirements include an interview in person or by interactive video to assess language skills.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of Music (M.Mus.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

In the Master of Music degree program, at least 18 credits must be at the 500 or 800 level, with at least 6 credits at the 500 level, and a comprehensive examination is required. The Master of Music degree (36 credits) offers four majors:

- Performance,
- Composition/Theory,
- Conducting,
- Performance and Pedagogy (piano and voice tracks).

The M.Mus. in Performance offers three separate curricula with areas of emphasis in: Voice, Keyboard, or Orchestral Instruments. Depending on the area of emphasis, a recital, a composition project, or a conducting project is required. For the M.Mus. in Performance with emphasis in voice or keyboard, a master's recital is required, in addition to either a master's paper or lecture-recital. For the M.Mus. in Performance (orchestral instruments), a master's recital is required.

For the M.Mus. in Composition/Theory, a composition project and a master's paper are required.

The M.Mus. in Conducting offers three areas of emphasis: Orchestral, Choral, or Band/Wind Ensemble. A performance project and a master's paper are required.

For the M.Mus. in Performance and Pedagogy, a master's recital is required, in addition to either a master's paper or lecture-recital.

The School of Music sponsors many musical ensembles, and candidates for performance degrees are required to participate in positions of responsibility. All candidates for degrees are expected to be in residence for a minimum of two semesters.

Master of Arts (M.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

In the Master of Arts degree program, at least 18 credits must be at the 500 level or higher, and a comprehensive examination is required. The Master of Arts in Music offers three tracks, in:

- Music Theory (32 credits),
- Musicology (32 credits), and
- Music Theory and History (34 credits).

All three tracks provide an interdisciplinary approach to the field of music scholarship, a hallmark of our program, and all tracks require a thesis. The track in Music Theory offers preparation in current modes of research and analysis from a music theoretical perspective. The track in Musicology emphasizes the development of a broad knowledge of music of all periods and, at the same time, cultivates one or more areas of specialization. The track in Music Theory and History provides greater breadth by integrating theoretical, analytical, and historical approaches to musical styles and works. A reading knowledge of German or another

appropriate language must be demonstrated before thesis credits may be scheduled.

Integrated Undergrad-Grad Programs

Integrated B.A. in Music and M.A. in Music

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The IUG program enables a select number of students to further their research interests at the undergraduate and graduate levels. By the end of the five-year program students receive two degrees, a B.A. in Music and an M.A. in Music.

Candidates for these Integrated Undergraduate-Graduate degrees must demonstrate a high level of aptitude and achievement in academic core courses and be highly motivated to pursue research projects with faculty.

The IUG program enables gifted music students to double count credits in two degree programs. As a result they will have developed a research focus during their fourth and fifth years, which will help them prepare for entry into doctoral programs at other institutions.

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students must apply to and meet admission requirements of the Graduate School (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>), as well as the graduate program in which they intend to receive their master's degree. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.

In consultation with an adviser, students must prepare a plan of study appropriate to this integrated program, and must present their plan of study to the head of the graduate program or the appropriate committee overseeing the integrated program prior to being admitted to the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.A. in Music are listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/bulletins/bluebook/>). Degree requirements for the M.A. degree are listed on the Degree Requirements tab. Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.A. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Integrated B.M. in Performance and M.A. in Music

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The IUG program enables a select number of students to further their research interests at the undergraduate and graduate levels. By the end of the five-year program students receive two degrees, a B.M. in Performance and an M.A. in Music.

Candidates for these Integrated Undergraduate-Graduate degrees must demonstrate a high level of aptitude and achievement in academic core courses and be highly motivated to pursue research projects with faculty.

The IUG program enables gifted music students to double count credits in two degree programs. As a result they will have developed a research focus during their fourth and fifth years, which will help them prepare for entry into doctoral programs at other institutions.

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students must apply to and meet admission requirements of the Graduate School (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>), as well as the graduate program in which they intend to receive their master's degree. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.

In consultation with an adviser, students must prepare a plan of study appropriate to this integrated program, and must present their plan of study to the head of the graduate program or the appropriate committee overseeing the integrated program prior to being admitted to the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.M. in Performance are listed in the Undergraduate Bulletin (<http://bulletins.psu.edu/bulletins/bluebook/>). Degree requirements for the M.A. degree are listed on the Degree Requirements tab. Up to 12 credits may be double-counted towards the

degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.A. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Music (MUSIC) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/music/>)

Contact

Campus	University Park
Graduate Program Head	Ann Marie Stanley
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Rachel E Copeland
Program Contact	Lacy Miller School of Music 233 Music Building I University Park PA 16802 ljs216@psu.edu (814) 865-5568
Program Website	View (https://arts.psu.edu/academics/school-of-music/)

Music Education

Graduate Program Head	Ann Marie Stanley
Program Code	MUED
Campus(es)	University Park (Ph.D., M.M.E.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Music Education (M.M.E.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=MUED)

The School of Music is an accredited institutional member of the National Association of Schools of Music.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The School of Music requires the completion of a recognized baccalaureate degree in music or music education, with a junior/senior grade-point average of 2.80 or higher (on a 4.00 scale). Admission to the M.M.E. program requires the completion of 12-15 credits in music education methods at the undergraduate level. Applicants are encouraged to submit evidence of successful teaching or student teaching experience. Admission to the Ph.D. requires an interview, submission of videotapes of teaching or conducting, and a portfolio of requested documents.

Additional requirements may include an interview in person or by interactive video to assess language skills.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of Music Education (M.M.E.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The Master of Music Education degree provides the opportunity for advanced study in music, music learning and teaching, and teaching as reflective practice. The program requires one to two full-time year(s) of residency at the University Park campus. Fulfillment of degree requirements includes successful completion of 30 credits of course work at the 400, 500, or 800 level that includes a final project designed by the student with the guidance of a faculty member. Twenty credits must be earned at the University Park campus and 18 credits must be at the 500 or 800 level, with at least 6 credits at the 500 level.

Required courses include upper-level (400, 500 or 800 level) course in music theory (2 cr. min.) and music history (3 cr. min.), at least one credit of music elective, one upper-level MUED course (3 cr.) (MUED 545, MUED 556, MUED 557 or MUED 558), one emphasis course (3 cr.) (MUSIC 441W, MUSIC 442W, MUSIC 443W, MUSIC 444W, MUSIC 445W or MUSIC 446W), MUED 860 (3 cr.), one enrichment course (1-5 cr.) (MUED 547, MUED 597*, MUED 559, MUED 895* or MUSIC 460), one research course (2 cr. min.) (MUED 540, MUED 550, MUSIC 500 or CI 501), and one education elective (3 cr. min.) (EDPSY 421, EDPSY 524, SPLED 403A or SPLED 403B, EDUC 806 or EDUC 839, The courses that satisfy the music theory and music history requirements can be chosen from a list of approved courses maintained by the graduate program office. The culminating experience for the degree is a capstone project completed while the student is enrolled in MUED 860.

*MUED 597 and MUED 895 must be approved by the program to fulfill this requirement.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The Ph.D. in Music Education is designed to provide opportunities for the highest level of scholarly study in the processes of teaching and learning music. Students are expected to develop and test new knowledge in the field of music education while preparing themselves for positions in higher education or other leadership roles within the profession. A qualifying exam, a doctoral dissertation, and comprehensive written and oral examinations are required.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)

- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Music Education (MUED) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/mued/>)

Learning Outcomes

Master of Music Education (M.M.E.)

1. Demonstrate increased, enhanced and deepened knowledge and understanding of effective, responsive, and ethical music teaching and learning. (KNOW, APPLY/CREATE, PROFESSIONAL PRACTICE)
2. Read and critically analyze research and scholarly contributions to the field. (KNOW, APPLY/CREATE, THINK)
3. Be able to creatively adapt and apply new knowledge to their own teaching practices. (KNOW, APPLY/CREATE, COMMUNICATE, THINK)
4. Demonstrate increased depth and breadth of creativity in musicianship, musical practice and music production. (KNOW, APPLY/CREATE, COMMUNICATE, THINK)
5. Communicate major issues within music education and their application to effective and musical teaching and learning. (KNOW, APPLY/CREATE, COMMUNICATE, THINK, PROFESSIONAL PRACTICE)

Contact

Campus	University Park
Graduate Program Head	Ann Marie Stanley
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Robert Gardner
Program Contact	Lacy Miller School of Music 233 Music Building I University Park PA 16802 ljs216@psu.edu (814) 865-5568
Program Website	View (https://arts.psu.edu/academics/school-of-music/)

Neuroscience (Hershey)

Graduate Program Head	Alistair Barber
Program Code	NEURO
Campus(es)	Hershey (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Dual-Title Ph.D. in Neuroscience and Clinical and Translational Sciences M.D./Ph.D.
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=NEURO)

The Neuroscience (NEURO) Graduate Program provides students curricular training with a broad focus on neuroscience, and the opportunity for concentrated research in a variety of disciplinary approaches to neuroscience such as biochemistry, cell biology, embryology, genetics, immunology, neuroscience, pharmacology, physiology, structural biology, and virology. Students receive rigorous training that provides the skills necessary to be leaders in biomedical research and other endeavors that benefit from a rigorous scientific background, including education, law, journalism, and public policy.

The Neuroscience Graduate Program is an interdepartmental program that engages faculty from multiple basic science and clinical science departments. This broad-reaching Program provides students a wide ranging understanding of multiple disciplines with specific expertise in a chosen area, and encourages interdisciplinary research that is the hallmark of biomedical sciences in the 21st century.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Prospective applicants should have a bachelor's degree in a biological, physical, or behavioral science and are expected to have taken undergraduate courses in biology, chemistry, physics, and mathematics. Applicants are expected to have a 3.0 (B) grade-point average or better. Neuroscience courses are desirable but not essential and research experience is an advantage.

A complete application includes:

- completed online Graduate School application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) with personal statement of purpose;
- official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>);
- three letters of recommendation; and
- TOEFL/IELTS scores (if applicable).

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

The application deadline is December 1st for admission in the following fall.

Qualified applicants generally will be requested to visit the College of Medicine in Hershey, PA for an interview. Admission is based on evaluation of the undergraduate transcript, personal statement of purpose, letters of recommendation, and performance at the interview.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

During the first year, students complete three research rotations that expose them to the wide range of research interests of The Pennsylvania State University Graduate Faculty from both basic and clinical science departments at the College of Medicine in Hershey. These rotations serve to inform the students with regard to choosing an adviser and forming a committee. In addition, students are advised to take ethics, statistics and electives.

A minimum of 30 credits at the 400, 500, 600, or 800 level is required for the M.S., with least 18 credits at the 500 and 600 level, combined. A thesis is required, and a minimum of six (6) thesis research credits (NEURO 600) must be taken in Neuroscience. The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School, and the student must pass a thesis defense.

Code	Title	Credits
Required Courses		
NEURO 511	Neurobiology II	3
NEURO 520	Cellular and Molecular Neuroscience	3
NEURO 521	Systems Neuroscience	3
NEURO 522	Seminars in Neuroscience I	2
NEURO 524	Neuroscience Bootcamp	2
BMS 591	Biomedical Research Ethics	1
Electives		
The remaining elective credits may be chosen from a list of approved 10 electives maintained by the program office.		
Culminating Experience		

NEURO 600	Thesis Research	6
Total Credits		30

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A minimum of 32 credits is required for the Ph.D. degree:

Code	Title	Credits
Required Courses		
<i>Core Requirements</i>		
BMS 502	Cell and Systems Biology	3
BMS 503	Advanced Molecular Genetics	3
NEURO 511	Neurobiology II	3
NEURO 520	Cellular and Molecular Neuroscience	3
NEURO 521	Systems Neuroscience	3
<i>Program Requirements</i>		
PHS 520	Principles of Biostatistics	3
NEURO 522	Seminars in Neuroscience I	2
NEURO 524	Neuroscience Bootcamp	2
NEURO 590	Colloquium	2
BMS 591	Biomedical Research Ethics	1
NEURO 602	Supervised Experience in College Teaching ¹	1
Electives		
A minimum of 6 elective credits is required.		6
Total Credits		31

¹ In addition, Ph.D. students are required to complete 1 credit of NEURO 602; however, this 1 credit cannot be counted towards the minimum 31 credits required.

A student's Ph.D. committee can require additional course work depending on the student's background and research plans.

Ph.D. degree requirements include successful completion of the following:

- approved graduate course work,
- English Competence requirements,
- a qualifying examination, which entails an oral presentation and a written examination on anatomical course work,
- a comprehensive examination, and
- a final oral examination (the dissertation defense).

To earn the Ph.D. degree, doctoral candidates must write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Titles

Dual-Title Ph.D. in Neuroscience and Clinical and Translational Sciences

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://>)

gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/).

Admission Requirements

Potential dual-title students can express an interest in the CTS dual-title as early as during the recruitment process for the Neuroscience Graduate Program. Students must apply and be admitted to the graduate program in Neuroscience and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admission requirements of the CTS dual-title program. Refer to the Admission Requirements section of the CTS Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/clinical-translational-sciences/>). Doctoral students must be admitted into the dual-title degree program in CTS prior to taking the qualifying exam in Neuroscience.

Students interested in the dual-title Ph.D. will be considered for admission to the Clinical and Translational Sciences Program by a committee consisting of the Clinical and Translational Sciences Program co-directors and faculty affiliated with the Clinical and Translational Sciences Dual-Title Program. To apply, the student must submit the following documentation to the Clinical and Translational Sciences Dual-title Program:

1. A statement of interest, including the applicant's reasons for pursuing a career that includes clinical/translational science.
2. A letter from the applicant's research adviser which endorses the applicant's participation in the Clinical and Translational Sciences dual-title program.
3. A letter of support from the head of Neuroscience. If the applicant has not yet selected a research adviser, the program head's letter should describe the program's support of the applicant's desire to incorporate clinical/translational research in the applicant's training plans.
4. A description of the applicant's academic performance to date.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Neuroscience. In addition, students must complete the degree requirements for the dual-title in CTS, listed on the CTS Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/clinical-translational-sciences/>). Up to 7 credits of course work may be used to satisfy both Neuroscience and CTS degree requirements. In addition, a student may request to double count additional credits up to a maximum of 12. An increase in double-counted credits will be determined by the CTS Program on a case-by-case basis.

Neuroscience graduate students accepted to the Clinical and Translational Sciences Dual-Title Program will take the qualifying exam by the end of the fourth semester of the graduate program:

1. to allow exposure to the Clinical and Translational Sciences curriculum in the Spring semester of the first year and Fall semester of the second year, which will prepare the students for the integrated content of the dual-title qualifying exam, and
2. to allow sufficient time to identify and assure commitment of an appropriate dissertation adviser who embraces the dual-title program of the student.

During the qualifying examination, the student will also be assessed for the dual-title program, and at least one member of the qualifying exam committee must come from the dual-title program. Faculty members who

hold appointments in both programs' Graduate Faculty may serve in a combined role.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Neuroscience and Clinical and Translational Sciences dual-title doctoral degree student must include at least one member of the Clinical and Translational Sciences Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in CTS, the member of the committee representing CTS must be appointed as co-chair. The CTS representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students enrolled in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and expertise in both Neuroscience and Clinical and Translational Sciences. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Joint Degrees

Joint M.D./Ph.D. with the college of Medicine

Requirements listed here are in addition to requirements listed in GCAC-211 Joint Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-211-joint-degree-programs/>).

Admission Requirements

Applicants to the joint M.D./Ph.D. degree program must apply and be admitted to both the Neuroscience graduate program and the College of Medicine.

Students interested in simultaneously pursuing an M.D. and Ph.D. degree must apply to the College of Medicine M.D. program using the national American Medical College Application Service (AMCAS) application system and indicate their intent to pursue the joint degree program. Admission requirements and applications for admission for Penn State College of Medicine are available at the M.D. Program (<http://med.psu.edu/md/>) section of the Penn State College of Medicine website. The College of Medicine M.D./Ph.D. Admissions Committee reviews applications and evaluates applicants for acceptance into both the M.D. and Ph.D. program. Students not accepted into the joint degree program can be referred to either the M.D. or Ph.D. program, depending on their qualifications and interests.

After the review committee has accepted an applicant to the joint degree program, they must apply and be admitted to the Graduate School (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>) for admission to the graduate program. Requirements for the joint degree, additional to the general admission requirements for the Ph.D. degree, are:

- **Academic Achievement.** Applicants to our program generally have very strong grades and MCAT scores. In recent years, successful applicants have an average GPA of 3.75 and total MCAT scores of >85 percentile.
- **Research Experience.** We are especially interested in students with a strong and sustained background in research. Students who have

spent 1-2 years after graduation conducting research are strongly encouraged to apply. Alternatively, in-depth research experience as an undergraduate can suffice.

- **Recommendations.** We are especially interested in receiving letters of recommendation from faculty with whom you conducted research and who can comment on your passion and potential for research.
- **Goals.** Applicants must be able to clearly articulate the reasons for pursuing the joint degree.
- **International Students.** All qualified students are eligible to apply regardless of citizenship.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the M.D. program are listed on the M.D. Program (<http://med.psu.edu/md/>) section of the Penn State College of Medicine website.

During the first two years of medical school, the student conducts at least three research rotations. In addition, students are required to take BMS 506A and BMS 506B during the M1 (Spring) and M2 (Fall), as well as either a 1 credit course in genetics or immunology. After successful completion of the first two years of medical school, the student joins their dissertation lab in the Neuroscience graduate program.

During the summer after the second year of medical school M.D./Ph.D. students take Step 1 of the United States Medical Licensing Examination (USMLE), which serves in lieu of the knowledge-based portion of the qualifying examination for the Neuroscience program.

The Ph.D. committee of an M.D./Ph.D. student in the Neuroscience program is formed upon entry into the dissertation laboratory. In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the committee must include at least two members of the Neuroscience program Graduate Faculty and one M.D./Ph.D. steering committee member.

In addition to taking the required courses NEURO 590, BMS 591, and PHS 520, students are required to take the core neuroscience courses: NEURO 521 and NEURO 522. A minimum of 4 elective credits is required. Other elective courses are selected in consultation with the student's dissertation adviser and Ph.D. committee.

Code	Title	Credits
Required Courses		
NEURO 520	Cellular and Molecular Neuroscience	3
NEURO 521	Systems Neuroscience	3
NEURO 522	Seminars in Neuroscience I	2
NEURO 524	Neuroscience Bootcamp	2
NEURO 590	Colloquium	2
BMS 591	Biomedical Research Ethics	1
PHS 520	Principles of Biostatistics	3
Electives		
A minimum of 4 elective credits is required. Other elective courses are selected in consultation with the student's dissertation adviser and Ph.D. committee.		4
Total Credits		20

The Neuroscience program will accept passing grades in the medical school courses SPM 711 (11 cr.) and NBS 723 (3 cr.) in lieu of following 9 required credits for the Neuroscience Ph.D.:

Code	Title	Credits
BMS 501	Regulation of Cellular & Systemic Energy Metabolism	3
BMS 502	Cell and Systems Biology	3
NEURO 511	Neurobiology II	3

M.D./Ph.D. students are not required to take NEURO 602 (1 cr.).

The M.D./Ph.D. student prepares a written comprehensive examination in the format of a grant application and gives an oral presentation of this proposal to their Ph.D. committee.

M.D./Ph.D. candidates are required to have at least one paper accepted for publication in a major peer-reviewed scientific journal prior to the final oral examination, and this must be accepted before they return to the third year of medical school. A student may petition to waive this requirement due to extenuating circumstances (e.g., adviser relocation, abnormal issues with publication process). All waivers must be approved by the Vice Dean for Research and Graduate Studies of the College of Medicine.

A dissertation must be prepared and defended by each M.D./Ph.D. candidate prior to returning to the M3 year of medical school. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School, and the student must pass the final oral examination (the dissertation defense).

If a student decides not to return to medical school, or for some other reason is not able to complete the last two years of medical school, but they have successfully completed their Ph.D. dissertation and final oral examination and met all other degree requirements of the Neuroscience program, they will be able to complete the Ph.D. The latter will be conferred after the student notifies the program that she/he wishes to withdraw from the M.D. program and completes all requirements for conferral of the graduate degree.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

All support is continuous for the first year from the Neuroscience program. Support in years two and above, when the student is conducting dissertation research, must be acquired from either the basic science department in which the student elects to pursue their minor or from funds available from the dissertation adviser. These funds must be secured by the student in conjunction with their adviser.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Neuroscience (NEURO) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/neuro/>)

Learning Outcomes

1. Describe the structural-functional organization of the nervous system at the cellular and systems levels
2. Describe the basic principles of neurotransmission
3. Explain the techniques used to analyze the structure and function of the nervous system
4. Develop testable hypotheses aimed at elucidating the structure or function of the nervous system
5. Develop an experimental plan that tests a specific set of hypotheses about nervous system structure or function following accepted professional standards for ensuring reproducibility
6. Conduct neuroscience research in which data are collected using ethical and professional standards
7. Present the results of a research project in a lucid and logical manner in both oral and written formats

Contact

Campus	Hershey Med Ctr
Graduate Program Head	Alistair J Barber
Program Contact	Kristin E Smith H170, College of Medicine 500 University Drive Hershey PA 17033 kec17@psu.edu (717) 531-1045
Program Website	View (http://med.psu.edu/neuroscience-phd/)

Neuroscience (Science)

Graduate Program Head	Sonia Cavigelli
Program Code	NERV
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=NERV)

The Neuroscience (NERV) Graduate Program at University Park is an Intercollege Graduate Degree Program affiliated with the Huck Institutes of the Life Sciences, the Eberly College of Science, and the College of Engineering. The program provides pedagogical and research training in the field of neuroscience which is inherently interdisciplinary and spans from molecules to organisms and utilizes both animal and human models. Students receive training in research and communications skills to enable them to succeed in careers in biomedical research and other professional fields related to the discipline. The Neuroscience Graduate Program engages faculty from the Colleges of Agriculture, Engineering, Health and Human Development, Information Sciences and Technology, Liberal Arts, and Science. Students gain a broad understanding of Neuroscience as well as specific expertise in their focused area of research..

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students are not accepted directly into the Neuroscience program as Master's degree candidates.

Prospective applicants should have a bachelor's degree in a biological, physical, or behavioral science and are expected to have taken undergraduate courses in biology, chemistry, physics, and mathematics. Applicants are expected to have a 3.0 (B) grade point average or better. Neuroscience courses are desirable but not essential and research experience is an advantage.

A complete application includes:

- completed online Graduate School application (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>) with personal statement of purpose for pursuing the degree;
- official transcripts from all post-secondary institutions attended (<https://gradschool.psu.edu/index.cfm/graduate-admissions/how-to-apply/new-applicants/requirements-for-graduate-admission/>)
- three letters of recommendation; and
- TOEFL/IELTS scores (if applicable).

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

The application deadline is December 15 for admission in the following fall.

Qualified applicants generally will be offered a visit the UP campus for an interview. Admission is based on evaluation of the undergraduate transcript, personal statement of purpose, letters of recommendation, and performance at the interview. International students will typically be interviewed virtually.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Students are not accepted directly into the Neuroscience program as Master's degree candidates. However, for various reasons, a student may need to discontinue their PhD program. Depending on the circumstances, the advisor and Thesis Committee may allow the student to finish the program by earning a Master's degree. During the first year, students complete three research rotations that expose them to the wide range of research interests of The Pennsylvania State University Graduate Faculty at the University Park Campus. These rotations serve to inform the students with regard to choosing an adviser and forming a committee. In addition, students are advised to take ethics, statistics and electives.

A minimum of 30 credits at the 400, 500, 600, or 800 level is required for the M.S., with least 18 credits at the 500 and 600 level, combined. A thesis is required, and a minimum of six (6) thesis research credits (NEURO 600 or NEURO 610) must be taken in Neuroscience. The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School, and the student must pass a thesis defense.

Code	Title	Credits
Required courses		
NEURO 501	Neuroscience Seminar	4
NEURO 512	Comparative Neuroanatomy	4
NEURO 520	Cellular and Molecular Neuroscience	3
NEURO 521	Systems Neuroscience	3
NEURO 596	Individual Studies	3
MCIBS 591	Ethics, Rigor, Reproducibility and Conduct of Research in the Life Sciences	2
Electives		
The remaining elective credits may be chosen from a list of approved electives maintained by the program office.		5
Culminating Experience		
NEURO 600	Thesis Research	6
	or NEURO 610 Thesis Research Off Campus	
Total Credits		30

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A minimum of 35 credits is required for the Ph.D. degree:

Code	Title	Credits
Required courses		
NEURO 501	Neuroscience Seminar	8
NEURO 512	Comparative Neuroanatomy	4
NEURO 520	Cellular and Molecular Neuroscience	3
NEURO 521	Systems Neuroscience	3
NEURO 596	Individual Studies	3
MCIBS 591	Ethics, Rigor, Reproducibility and Conduct of Research in the Life Sciences	2
Electives		
The remaining elective credits may be chosen from a list of approved electives maintained by the program office.		6
Culminating Experience		
NEURO 600	Thesis Research	6
	or NEURO 610 Thesis Research Off Campus	
Total Credits		35

In addition, Ph.D. students are required to complete 1 credit of NEURO 602; however, this 1 credit cannot be counted towards the minimum 35 credits required.

A student's Ph.D. committee can require additional course work depending on the student's background and research plans.

Ph.D. degree requirements include successful completion of the following:

- approved graduate course work,
- English Competence requirements,
- A qualifying examination, which entails oral and written components
- a comprehensive examination, and
- a final oral examination (the dissertation defense).

To earn the Ph.D. degree, doctoral candidates must write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

Students graduating from this program will be able to:

1. Explain the structure and function of the nervous system at the molecular, cellular, and systems levels with respect to:
 - a. Their role in generating behavior, cognition, and emotion.
 - b. The processes associated with neurodevelopment, homeostasis, and aging.
 - c. The development and expression of neurological and mental health diseases.
2. Describe the mechanisms by which neurons and other cells in the nervous system communicate via chemical and electrical signals.
3. Explain the experimental approaches that can be used to interrogate the anatomy, physiology, and function of the nervous system and how these can lead to disfunction and disease.
4. Demonstrate the ability to develop and test hypotheses regarding the structure, function, and diseases of the nervous system.
5. Develop a rigorous experimental approach to test hypotheses about the function, anatomy, and physiology of the nervous system.
6. Conduct neuroscience research in which experiments are performed in a rigorous and ethical manner consistent with professional standards.
7. Develop the ability to communicate research results in a clear and comprehensive manner in both oral and written formats.

Contact

Campus	University Park
Graduate Program Head	Sonia Angele Cavigelli
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Sonia Angele Cavigelli
Program Contact	Jean Pierce jep32@psu.edu (814) 867-0371
Program Website	View (https://www.huck.psu.edu/graduate-programs/neuroscience/)

Nuclear Engineering

Graduate Program Head	Jon Schwantes
Program Code	NUCE
Campus(es)	University Park (Ph.D., M.S., M.Eng.) World Campus (M.Eng.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Master of Engineering (M.Eng.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=NUCE)

Research areas include:

- Nuclear Science and Applications
- Nuclear Materials
- Nuclear Thermal Hydraulics
- Reactor Physics and Advanced Reactor Design
- Plasma Physics and Engineering
- Nuclear Security, Safeguards, and Safety
- Nuclear Fuel Cycle

Application areas include:

- Advanced Reactor Design
- Nuclear Safety Analysis
- Radiation Instrumentation Development
- Space Nuclear
- Nuclear Nonproliferation Safety and Security
- Plasma Technologies
- Fusion Reactor Design
- Advanced Thermal Hydraulic Modeling
- Neutron Imaging

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students with a 3.00 junior/senior grade-point average and with appropriate course backgrounds will be considered for admission. Scores from the Graduate Record Examination (GRE) test results are optional. The best-qualified applicants will be accepted up to the number of spaces that are available for new students. Exceptions to the minimum 3.00 grade-point average may be made for students with special backgrounds, abilities, and interests.

Letters of recommendation and a statement of purpose written by the applicant are also required to complete the application package.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of Engineering (M.Eng.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The M.Eng. degree is a nonthesis professional master's degree. In the M.Eng. degree program, a minimum of 30 credits at the 400, 500, or 800 level is required. Twelve of those credits must be in Nuclear Engineering with at least 18 credits at the 500 level. There are 6 credits required in the following core courses: NUCE 403 Advanced Reactor Design (3 cr.) and NUCE 450 Radiation Detection and Measurement (3 cr.). These may be waived as required courses at the discretion of the program if the student has already taken them or equivalent courses. The culminating experience for the M.Eng. degree is a scholarly paper completed while the student is enrolled in NUCE 596. The scholarly paper must be approved by the adviser, a faculty reader, and the program chair.

Nuclear Security Option

An option in Nuclear Security is available for either the M.S. or the M.Eng. degree. To complete the option, students must complete 15 credits:

Code	Title	Credits
Required Courses		
NUCE 441	Nuclear Security Threat Analysis and Assessments	3
NUCE 442	Nuclear Security System Design	3
NUCE 542	Source and Detector Technologies for Nuclear Security	3
NUCE 543	Nuclear Security Education Laboratory	3
NUCE 544	Global Nuclear Security Policies	3
Total Credits		15

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The M.S. degree program is designed for students to gain advanced knowledge for research, analysis, and design in nuclear engineering. Students pursuing an M.S. degree must complete a minimum of 30 credits at the 400, 500, 600, or 800 levels, with at least 18 credits at the 500 and 600 level, combined. The program requires 6 credits in the following core courses: NUCE 403 Advanced Reactor Design (3 cr.) and NUCE 450 Radiation Detection and Measurement (3 cr.). These may be waived as required courses at the discretion of the program if the student has already taken them or equivalent courses. Students are required to write a thesis, and at least 6 credits in thesis research (NUCE 600 or NUCE 610) must be taken in conjunction with completing the thesis. The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School.

Nuclear Security Option

An option in Nuclear Security is available for either the M.S. or the M.Eng. degree. To complete the option, students must complete 15 credits:

Code	Title	Credits
Required Courses		
NUCE 441	Nuclear Security Threat Analysis and Assessments	3

NUCE 442	Nuclear Security System Design	3
NUCE 542	Source and Detector Technologies for Nuclear Security	3
NUCE 543	Nuclear Security Education Laboratory	3
NUCE 544	Global Nuclear Security Policies	3
Total Credits		15

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The Ph.D. program emphasizes scholarly research and helps students prepare for research and related careers in industry, government, and academe. The Ph.D. program is quite flexible, with minimal formal requirements. Doctoral students must pass a qualifying examination, a comprehensive written and oral examination, and a final oral examination (the dissertation defense). Generally, a Ph.D. student must have 30 credits above a master's degree before taking a comprehensive examination. To earn the Ph.D. degree, doctoral students must also write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

In addition, the following awards typically have been available to graduate students in this program:

U.S. Nuclear Regulatory Commission Fellowships

Available to graduate students interested in working in nuclear engineering, covering stipend and tuition.

U.S. Department of Energy-Nuclear Science and Engineering Fellowships

Available to graduate students interested in engineering and engineering support related to nuclear technology; stipend plus tuition.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Nuclear Engineering (NUCE) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/nuce/>)

Contact

Campus	University Park
Graduate Program Head	Jon Michael Schwantes
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Dipanjan Pan
Program Contact	Ashley Linn Ammerman 113 Hallowell Building University Park PA 16802 alb5678@psu.edu (814) 865-5940
Program Website	View (http://www.nuce.psu.edu)
Campus	World Campus
Graduate Program Head	Jon Michael Schwantes
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Dipanjan Pan
Program Contact	Ashley Linn Ammerman 113 Hallowell Building University Park PA 16802 alb5678@psu.edu (814) 865-5940
Program Website	View (http://www.nuce.psu.edu)

Nursing

Graduate Program Head	Judith Hupcey
Program Code	NURS
Campus(es)	University Park (Ph.D.) World Campus (D.N.P., M.S.N.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Doctor of Nursing Practice (D.N.P.) Master of Science in Nursing (M.S.N.) Dual-Title Ph.D. in Nursing and Bioethics Dual-Title Ph.D. in Nursing and Clinical and Translational Science
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=NURS)

The graduate programs emphasize productive scholarship and research in the development of nursing knowledge and the translation of knowledge into practice. Advanced study is in human health and development throughout the life span, and in nursing's role in providing health services to individuals, families, and communities.

The Ph.D. program, the dual-title Ph.D. program in nursing and bioethics, and the dual-title Ph.D. program in nursing and clinical and translational sciences prepare scientists to provide leadership in nursing education, practice and research. Individualized curricula prepare graduates to assume positions as faculty, researchers and leaders in educational, community, governmental, or institutional settings.

The D.N.P. degree program consists of a base program and five options. The options include:

- Family/Individual Across the Lifespan Nurse Practitioner
- Adult Gerontology Primary Care Nurse Practitioner
- Adult Gerontology Acute Care Nurse Practitioner
- Leadership
- Psychiatric Mental Health Nurse Practitioner

The Nurse Practitioner options are designed to help prepare the professional nurse to function in an expanded nursing role providing direct care to specific groups of clients in a variety of health care settings. Since that practice is inherently interdisciplinary in nature, advanced knowledge and research from nursing is combined with knowledge from science, medicine, and related disciplines. The Nurse Practitioner may also function in supervisory, consultative, education, and research roles.

The Leadership option prepares nurses to assume leadership roles in practice settings in the community, governmental agencies, or healthcare institutions.

The M.S.N. and D.N.P. degree programs in Nursing are accredited by the Commission on Collegiate Nursing Education.

The M.S.N. degree in Nursing consists of a base program and two options. The options include:

- Nurse Administrator
- Nurse Educator

The Nurse Administrator option enables the student to acquire advanced knowledge of organizational leadership, health policy, and evidence-based health care delivery. The program is designed to prepare students for leadership and administrative roles in a variety of health care settings.

The Nurse Educator option enables the student to acquire advanced knowledge of evidence-based teaching and learning principles, curriculum development, and evaluative techniques. The program is designed to prepare students for educator roles in a variety of academic and health care settings.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

For admission to the Nursing program, an applicant must hold either:

- a bachelor's degree in Nursing from a U.S. regionally accredited institution or
- a postsecondary degree in Nursing that is equivalent to a U.S. baccalaureate degree earned from an officially recognized degree-granting international institution. Students entering the doctoral program via the traditional post-master's route must have earned a master's degree with a major in nursing from a program accredited by a national accrediting agency for nursing. Well-qualified Ph.D. applicants with a baccalaureate degree in nursing and master's degree in a related discipline (e.g., public health) will be evaluated individually to assess the need for prerequisite master's-level course work in nursing for doctoral program admission.

Applicants must submit official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>). For M.S.N. applicants, a cumulative grade-point average of 3.3 (on a 4.0 scale) for the baccalaureate degree is expected with a B or better in all science and nursing courses. College chemistry and statistics are also required (chemistry is not required for the nurse administrator option). B.S.N. to D.N.P. applicants are expected to have a cumulative undergraduate grade-point average of 3.5 (on a 4.0 scale) with a B or better in all science and nursing courses. College chemistry and statistics are also required (chemistry is not required for the leadership option). For master's to Ph.D. or D.N.P. applicants, a cumulative grade-point average 3.5 (on a 4.0 scale) for master's and subsequent course work is expected.

Two letters of reference are required for the M.S.N. degree program and three letters of reference are required for the D.N.P. and Ph.D. degree programs. The letters should be solicited from professional supervisors and faculty who can attest to the applicant's ability. If a degree was completed in the last 5 years, an academic reference is required.

All applicants must submit a statement of purpose. In addition, D.N.P. and Ph.D. degree applicants must also submit a published or unpublished scientific paper, thesis, or other scholarly writing sample and a complete curriculum vitae.

GRE scores are optional for admission to the Ph.D. program. GRE scores are not required for the M.S.N. or D.N.P. applicants, but if the scores are submitted to Penn State they will be reviewed as part of the application.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Applicants to the Nursing program must have a minimum TOEFL total score of 80 with a 25 on the speaking section for the internet-based test (iBT). For the paper-based test, taken prior to July 2017, a minimum of 580 is required. The minimum composite score for the IELTS for applicants to the Nursing program is 7.

Applicants to the M.S.N. options and D.N.P. degree offered online via the World Campus must hold a current license to practice professional nursing in at least one U.S. state or in a foreign country. Those applying to a nurse practitioner option must hold a current Pennsylvania license to practice professional nursing. Nursing applicants to the Ph.D. degree program must be licensed to practice professional nursing in at least one state or in a foreign country.

Applicants to the Adult Gerontology Acute Care Nurse Practitioner Option are required to have two years of acute care hospital experience.

Applicants to the M.S.N. and D.N.P. degree program are encouraged to discuss program options with the faculty; however, an interview is not required. PhD applicants will be contacted by the College of Nursing to schedule a required interview (either in person or via internet-based video conferencing).

Degree Requirements

Master of Science in Nursing (M.S.N.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The Master of Science in Nursing (M.S.N.) requires a minimum of 30 credits at the 400, 500, or 800 level, with a minimum of 18 credits at the 500 or 800 level, and at least 6 credits at the 500 level, including:

- 9 credits of M.S.N. Program Core courses,
- 18 credits of electives, and
- at least 3 credits in a capstone course or project.

Code	Title	Credits
Required Courses		
<i>M.S.N. Program Core</i>		
NURS 501	Issues in Nursing and Health Care	3
NURS 510	Theoretical and Scientific Foundations of Advanced Nursing Practice	3
NURS 830	Evidence-Based Practice I: Inquiry and Research Methods	3
Electives		
Additional courses that will count as electives towards this degree can be chosen from a list of approved elective courses maintained by the graduate program office.		18
Culminating Experience		

Students in the M.S.N. degree program are required to complete a capstone course or project, which demonstrates the application of theory and research to a clinical problem based on review of the literature and research utilization for that problem. For M.S.N. students who do not choose to complete an option, a capstone project is completed while enrolled in NURS 596 (3 credits).

Total Credits 30

The two advanced role options offered in the M.S.N. degree program include nurse educator and nurse administrator. Students in these options complete the 9 credits of M.S.N. Program Courses as described above. The option-specific course requirements described below replace the requirement for 18 credits of electives.

Nurse Administrator Option

Students must earn a minimum of 36 credits for the M.S.N. with the Nurse Administrator option.

Code	Title	Credits
Required Courses		
NURS 501	Issues in Nursing and Health Care	3
NURS 510	Theoretical and Scientific Foundations of Advanced Nursing Practice	3
NURS 830	Evidence-Based Practice I: Inquiry and Research Methods	3
<i>Nurse Administrator Option Required Courses</i>		
NURS 808	Population Health Perspectives	3
NURS 836	Healthcare Informatics	3
NURS 845	Healthcare Economics and Policy for Nurse Administrators	3
NURS 846	Leadership Concepts and Theories for Nurse Administrators	3
NURS 847	Human Resource and Work Force Issues for Nurse Administrators	3
Electives		
Students in this option are required to take 6 additional elective credits chosen from a list of approved elective courses maintained by the graduate program office.		6
Culminating Experience		
NURS 848	Synthesis and Application of the Nurse Administrator Role (Capstone Course)	6
Total Credits		36

Nurse Educator Option

Students must earn a minimum of 36 credits for the M.S.N. with the Nurse Educator option.

Code	Title	Credits
Required Courses		
NURS 501	Issues in Nursing and Health Care	3
NURS 510	Theoretical and Scientific Foundations of Advanced Nursing Practice	3
NURS 830	Evidence-Based Practice I: Inquiry and Research Methods	3
<i>Nurse Educator Option Required Courses</i>		
NURS 802B	Physical Assessment Through The Lifespan	3
NURS 803	Pathophysiology for the Advanced Practice Nurse	3

NURS 804	Pharmacologic Therapy for the Advanced Practice Nurse	3
NURS 836	Healthcare Informatics	3
NURS 840	Nursing Education Theories and Strategies	3
NURS 841	Assessment and Evaluation in Nursing Education	3
NURS 842	Curriculum and Program Development in Nursing Education	3

Culminating Experience

NURS 843	Synthesis and Application of the Nurse Educator Role (Capstone Course)	6
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Total Credits 36

Doctor of Nursing Practice (D.N.P.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students may enter the program directly with a B.S.N. degree or following completion of a Master's degree in nursing.

For the B.S.N. to the D.N.P., a core of master's courses is required. A minimum of 60 credits, 1000 hours of practicum time, and a DNP project is required. The 60 credits include:

Code	Title	Credits
Required Courses		
<i>Master's Core Courses</i>		
NURS 510	Theoretical and Scientific Foundations of Advanced Nursing Practice	3
NURS 830	Evidence-Based Practice I: Inquiry and Research Methods	3
NURS 845	Healthcare Economics and Policy for Nurse Administrators	3
NURS 831	Evidence-Based Practice II: Translating Inquiry into Practice	3
NURS 832	Doctor of Nursing Practice: Leadership I	3
NURS 837	Evidence-Based Practice III: Project Development	3
NURS 590	Colloquium	1
NURS 887	Ethics in Professional Nursing Practice	1
NURS 836	Healthcare Informatics	3
NURS 808	Population Health Perspectives	3
<i>Advanced Practice Clinical</i>		
		3

If needed to meet the 1000 hour practicum requirement. Students in one of the Nurse Practitioner options do not need NURS 834.

NURS 834	Doctor of Nursing Practice Clinical Practicum	3-4
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Other Required Courses for Base Program (Students not in an option)

NURS 501	Issues in Nursing and Health Care	3
NURS 588	Healthcare Policy for Nurse and Healthcare Scholars	3

Electives

14-15 credits of electives chosen from a list of approved elective courses maintained by the graduate program office

Culminating Experience

NURS 835	Doctor of Nursing Practice Project (Only 4 credits of NURS 835 needed for the NP Options)	6
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Total Credits 60

The Master of Science in Nursing (M.S.N.) to D.N.P. program requires a minimum of 30 post-master's degree credits completed at Penn State. The curriculum is individualized based on previous course work and number of practicum hours completed during the master's program. A maximum of 550 practicum hours from the previous master's program will be accepted to fulfill the 1000 hours of required practicum hours. The curriculum is composed of 5 components, for a minimum of 38 credits:

Code	Title	Credits
Required Courses		
<i>D.N.P. Core Courses</i>		
NURS 830	Evidence-Based Practice I: Inquiry and Research Methods	3
NURS 831	Evidence-Based Practice II: Translating Inquiry into Practice	3
NURS 832	Doctor of Nursing Practice: Leadership I	3
NURS 833	Doctor of Nursing Practice: Leadership II	3
NURS 837	Evidence-Based Practice III: Project Development	3
NURS 590	Colloquium	1
NURS 887	Ethics in Professional Nursing Practice	1
NURS 808	Population Health Perspectives	3
NURS 836	Healthcare Informatics	3
NURS 845	Healthcare Economics and Policy for Nurse Administrators	3
Electives		
6 credits of electives chosen from a list of approved elective courses maintained by the graduate program office		6
Culminating Experience		
NURS 835	Doctor of Nursing Practice Project	6
Total Credits		38

In addition to the minimum 38 credits, up to 7 credits of NURS 834 may be required for M.S.N. to D.N.P. students, depending on the number of practicum hours completed in the student's M.S.N. program.

For students in the Leadership Option, students are required to participate in 2 intensives offered at the University Park or Hershey Medical Center campus. For full-time students, the first intensive is August of semester I for M.S.N. to D.N.P. and Semester III for B.S.N. to D.N.P. students. Intensive 2 is at the end of semester II for M.S.N. to D.N.P. and semester IV for B.S.N. to D.N.P. students. For students in the Nurse Practitioner Options, three intensives are required at the University Park Campus or the Hershey Campus. The first intensive is Semester 2 in August prior to the beginning of the Fall Semester. The second intensive is during Semester 4 at the end of July or early August. The third intensive is at the beginning of Semester 7 (Summer) during May. For part-time M.S.N. to D.N.P. students the first intensive is August of semester III and intensive 2 is the end of semester IV.

In addition to course work, all students are required to complete a series of three benchmarks, Qualifying Examination, Comprehensive Examination, and a Final Oral Presentation.

D.N.P. Doctoral Committee Composition

The doctoral committee will consist of the student's academic adviser and two additional members of the Graduate Faculty. The academic adviser will be the chair of the committee.

Qualifying Examination

All students must satisfactorily complete the qualifying examination, which is designed to evaluate the student's past performance and potential for successfully completing the program. The qualifying examination occurs prior to the 2nd intensive, which follows completion of one semester of full-time study for the M.S.N. to D.N.P. student, and within three semesters of full-time study for the B.S.N. to D.N.P. student. Students who fail the examination on the first attempt may repeat it once. Students who fail the examination the second time are terminated from the program.

Comprehensive Examination

The comprehensive examination marks the student's progression into their D.N.P. project. Students will present their D.N.P. project proposal. The comprehensive examination needs to be successfully completed prior to the submission of the proposal for human subjects' review or carrying out the project (if it does not require a review). Students who fail the examination on the first attempt may repeat it once. Students who fail the examination the second time are terminated from the program.

Final Oral Presentation

Upon completion of the project, the Final Oral Presentation is scheduled. Students are required to present the project for approval by their doctoral committee. The Associate Dean for Graduate Education & Research will sign off on the final paper, following completion of the paper during NURS 835 and the student's passing of the oral presentation. Students who fail the presentation on the first attempt may repeat it once. The student's final paper will be made publicly available through ScholarSphere (<https://scholarsphere.psu.edu/>).

Options

The five options offered in the D.N.P. degree program include: Leadership, Family/Individual across the Lifespan Nurse Practitioner, Adult Gerontology Primary Care Nurse Practitioner, Adult Gerontology Acute Care Nurse Practitioner, and Psychiatric Mental Health Nurse Practitioner. Students in these options complete the D.N.P. Program Courses as described above. The option specific course requirements described below replace the required elective credits.

Leadership Option

Students must earn a minimum of 61 credits and complete a minimum of 1000 practicum hours for the D.N.P. with the Leadership option.

Code	Title	Credits
Required Courses		
<i>D.N.P. Core Courses</i>		
NURS 510	Theoretical and Scientific Foundations of Advanced Nursing Practice	3
NURS 590	Colloquium	1
NURS 830	Evidence-Based Practice I: Inquiry and Research Methods	3
NURS 831	Evidence-Based Practice II: Translating Inquiry into Practice	3
NURS 832	Doctor of Nursing Practice: Leadership I	3
NURS 836	Healthcare Informatics	3
NURS 837	Evidence-Based Practice III: Project Development	3
NURS 845	Healthcare Economics and Policy for Nurse Administrators	3
NURS 887	Ethics in Professional Nursing Practice	1
NURS 808	Population Health Perspectives	3

Leadership Option Required Courses

NURS 501	Issues in Nursing and Health Care	3
NURS 833	Doctor of Nursing Practice: Leadership II	3
NURS 846	Leadership Concepts and Theories for Nurse Administrators	3
NURS 847	Human Resource and Work Force Issues for Nurse Administrators	3
NURS 848A	Synthesis and Application of the Nurse Administrator Role	4
STAT 507	Epidemiologic Research Methods	3
<i>Advanced Practice Clinical (Needed to meet the 1000 hour practicum requirement)</i>		
NURS 834	Doctor of Nursing Practice Clinical Practicum	4
Electives		
6 credits of an administrative elective chosen from a list of approved elective courses maintained by the graduate program office		6
Culminating Experience		
NURS 835	Doctor of Nursing Practice Project	6
Total Credits		61

Family/ Individual Across the Lifespan Nurse Practitioner Option

Students must earn a minimum of 67 credits and complete a minimum of 1125 practicum hours for the D.N.P. with the Family/Individual Across the Lifespan Nurse Practitioner option.

Code	Title	Credits
Required Courses		
<i>D.N.P. Core Courses</i>		
NURS 510	Theoretical and Scientific Foundations of Advanced Nursing Practice	3
NURS 590	Colloquium	1
NURS 830	Evidence-Based Practice I: Inquiry and Research Methods	3
NURS 831	Evidence-Based Practice II: Translating Inquiry into Practice	3
NURS 832	Doctor of Nursing Practice: Leadership I	3
NURS 836	Healthcare Informatics	3
NURS 837	Evidence-Based Practice III: Project Development	3
NURS 845	Healthcare Economics and Policy for Nurse Administrators	3
NURS 887	Ethics in Professional Nursing Practice	1
NURS 808	Population Health Perspectives	3
<i>Family/ Individual Across the Lifespan Nurse Practitioner Option Required Courses</i>		
NURS 802	Advanced Health Assessment of Adult Populations	3
NURS 803	Pathophysiology for the Advanced Practice Nurse	3
NURS 804	Pharmacologic Therapy for the Advanced Practice Nurse	3
NURS 588	Healthcare Policy for Nurse and Healthcare Scholars	3
NURS 870F	Family Nurse Practitioner Role with Healthy Family/Individual	3
NURS 871F	Family Nurse Practitioner Role with Individuals and Families with Complex and/or Chronic Health Prob	3

NURS 802A	Advanced Health Assessment of Pediatric Populations	1
NURS 872F	Family/Individual Across the Lifespan Nurse Practitioner Doctoral Practicum I	2
NURS 873F	Family/Individual Across the Lifespan Nurse Practitioner Doctoral Practicum II	3
NURS 874F	Family/Individual Across the Lifespan Nurse Practitioner Integrative Doctoral Practicum	5
NURS 875	Nurse Practitioner Role with Children and Families	2
NURS 876F	Family/Individual Across the Lifespan Nurse Practitioner Doctoral Practicum in Child Health	1
NURS 877F	Clinical Practice Synthesis for Family/Individual Across the Lifespan Nurse Practitioner	3
Culminating Experience		
NURS 835	Doctor of Nursing Practice Project	6
Total Credits		67

Adult Gerontology Primary Care Nurse Practitioner Option

Students must earn a minimum of 64 credits and complete a minimum of 1125 practicum hours for the D.N.P. with the Adult Gerontology Primary Care Nurse Practitioner Option

Code	Title	Credits
Required Courses		
<i>D.N.P. Core Courses</i>		
NURS 510	Theoretical and Scientific Foundations of Advanced Nursing Practice	3
NURS 590	Colloquium	1
NURS 830	Evidence-Based Practice I: Inquiry and Research Methods	3
NURS 831	Evidence-Based Practice II: Translating Inquiry into Practice	3
NURS 832	Doctor of Nursing Practice: Leadership I	3
NURS 836	Healthcare Informatics	3
NURS 837	Evidence-Based Practice III: Project Development	3
NURS 845	Healthcare Economics and Policy for Nurse Administrators	3
NURS 887	Ethics in Professional Nursing Practice	1
NURS 808	Population Health Perspectives	3
<i>Adult Gerontology Primary Care Nurse Practitioner Option Required Courses</i>		
NURS 802	Advanced Health Assessment of Adult Populations	3
NURS 803	Pathophysiology for the Advanced Practice Nurse	3
NURS 804	Pharmacologic Therapy for the Advanced Practice Nurse	3
NURS 588	Healthcare Policy for Nurse and Healthcare Scholars	3
NURS 870	Nurse Practitioner Role with Healthy Individuals and Families	3
NURS 871	Nurse Practitioner Role with Individuals and Families with Complex and/or Chronic Health Problems	3
NURS 872D	Adult Gerontology Primary Care Nurse Practitioner Doctoral Practicum I	3

NURS 873D	Adult Gerontology Primary Care Nurse Practitioner Doctoral Practicum II	3
NURS 874D	Adult Gerontology Primary Care Nurse Practitioner Integrative Doctoral Practicum	5
NURS 877	Clinical Practice Synthesis for Adult Gerontology Primary Care Nurse Practitioner	3

Culminating Experience

NURS 835	Doctor of Nursing Practice Project	6
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Total Credits **64**

Adult Gerontology Acute Care Nurse practitioner Option

Students must earn a minimum of 66 credits and complete a minimum of 1125 practicum hours for the D.N.P. with the Adult Gerontology Acute Care Nurse Practitioner Option

Code	Title	Credits
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Required Courses*D.N.P. Core Courses*

NURS 510	Theoretical and Scientific Foundations of Advanced Nursing Practice	3
NURS 590	Colloquium	1
NURS 830	Evidence-Based Practice I: Inquiry and Research Methods	3
NURS 831	Evidence-Based Practice II: Translating Inquiry into Practice	3
NURS 832	Doctor of Nursing Practice: Leadership I	3
NURS 836	Healthcare Informatics	3
NURS 837	Evidence-Based Practice III: Project Development	3
NURS 845	Healthcare Economics and Policy for Nurse Administrators	3
NURS 887	Ethics in Professional Nursing Practice	1
NURS 808	Population Health Perspectives	3

Adult Gerontology Acute Care Nurse Practitioner Option Required Courses

NURS 802	Advanced Health Assessment of Adult Populations	3
NURS 803	Pathophysiology for the Advanced Practice Nurse	3
NURS 804	Pharmacologic Therapy for the Advanced Practice Nurse	3
NURS 588	Healthcare Policy for Nurse and Healthcare Scholars	3
NURS 860	Adult Gerontology Acute Care Nurse Practitioner Role I	3
NURS 861	Adult Gerontology Acute Care Nurse Practitioner Role II	3
NURS 862D	Adult Gerontology Acute Care Nurse Practitioner Doctoral Practicum I	3
NURS 863D	Adult Gerontology Acute Care Nurse Practitioner Doctoral Practicum II	3
NURS 864D	Adult Gerontology Acute Care Nurse Practitioner Integrative Doctoral Practicum	5
NURS 865	Pharmacology for Acute Care Nurse Practitioners	1
NURS 866	Health Assessment of the Adult Gerontology Population in Acute Care	1
NURS 867	Clinical Practice Synthesis for Adult Gerontology Acute Care Nurse Practitioner	3

Culminating Experience

NURS 835	Doctor of Nursing Practice Project	6
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Total Credits **66**

Psychiatric Mental Health Nurse Practitioner Option

Students must earn a minimum of 72 credits and complete a minimum of practicum 1125 hours for the D.N.P. with the mental health individual.

Code	Title	Credits
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Required Courses*D.N.P. Core Courses*

NURS 510	Theoretical and Scientific Foundations of Advanced Nursing Practice	3
NURS 590	Colloquium	1
NURS 830	Evidence-Based Practice I: Inquiry and Research Methods	3
NURS 831	Evidence-Based Practice II: Translating Inquiry into Practice	3
NURS 832	Doctor of Nursing Practice: Leadership I	3
NURS 836	Healthcare Informatics	3
NURS 837	Evidence-Based Practice III: Project Development	3
NURS 845	Healthcare Economics and Policy for Nurse Administrators	3
NURS 887	Ethics in Professional Nursing Practice	1
NURS 808	Population Health Perspectives	3

Psychiatric Mental Health Nurse Practitioner Option Required Courses

NURS 802	Advanced Health Assessment of Adult Populations	3
NURS 802M	Psych MHNP Integrative Biopsychosocial Assessment & Differential Diagnosis Across the Lifespan	2
NURS 803	Pathophysiology for the Advanced Practice Nurse	3
NURS 804	Pharmacologic Therapy for the Advanced Practice Nurse	3
NURS 807	Cognitive Behavioral Therapy for Advanced Nursing Practice	2
NURS 809	Crisis and Trauma-Informed Care for Advanced Nursing Practice	2
NURS 810	Theoretical Foundation and Application of Psychotherapy with Individuals, Groups, and Families	3
NURS 811	Family and Organizational Systems Across the Lifespan for Advanced Nursing Practice	2
NURS 870M	Neuroscience and Psychobiology of Mental Illness and Across the Lifespan	3
NURS 871M	Neuropsychopharmacology and Biologically Based Treatments Across the Lifespan	3
NURS 872M	Psychiatric Mental Health Across the Lifespan Nurse Practitioner Doctoral Practicum I	3
NURS 873M	Psychiatric Mental Health Across the Lifespan Nurse Practitioner Doctoral Practicum II	3
NURS 874M	Psychiatric Mental Health Across the Lifespan Nurse Practitioner Integrative Doctoral Practicum	5
NURS 877M	Clinical Practice Synthesis for Psychiatric Mental Health Across the Lifespan Nurse Practitioner	3

Culminating Experience

NURS 835	Doctor of Nursing Practice Project	6
Total Credits		72

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Students may enter the program directly with a B.S.N. degree or following completion of a B.S.N. and a Master's degree (either in Nursing or non-Nursing).

Students entering with an M.S.N. will complete a minimum of 43 credits. The curriculum is composed of 3 components:

Code	Title	Credits
Required Courses		
<i>Nursing Science Core Courses</i>		
NURS 580	Theoretical and Philosophical Basis of Nursing	3
NURS 582	Literature Synthesis for Nursing Science	4
NURS 583	Advanced Seminar in Nursing Science	3
NURS 587	Ethics in Health Research	1
NURS 588	Healthcare Policy for Nurse and Healthcare Scholars	3
NURS 590	Colloquium	2
<i>Research Methodology and Statistics</i>		
Minimum of 15 credits approved by the student's adviser and/or Ph.D. committee		15
<i>Courses for Individual Specialty</i>		
Minimum of 12 credits; minimum of 15 credits for a minor		12-15
Total Credits		43

¹ Required of students who are not research assistants on an active faculty research study.

In addition to course work, all students are required to complete a series of examinations: the Qualifying Examination, the Comprehensive Examination (written and oral components), the Dissertation Proposal Defense, and Final Oral Examination. Students are required to pass the Final Oral Examination, have the dissertation approved and submitted, and graduate within five years of passing the qualifying examination.

Qualifying Examination

All students must satisfactorily complete the qualifying examination, which is designed to confirm the student's mastery of basic nursing theory and research methods. For students entering the doctoral program with a master's degree, the qualifying examination must be taken at the end of the first year of full-time study or the equivalent. Students who fail the examination on the first attempt may repeat it once. Students who fail the examination the second time are terminated from the program.

Comprehensive Examination

The comprehensive examination is designed to test the student's mastery of and ability to synthesize and integrate the theoretical basis for nursing science, advanced research methods, and the chosen specialty area. This examination is taken when a student has substantially completed all course work. Students who fail the examination on the first attempt may repeat it once. Students who fail the examination the second time are terminated from the program.

Dissertation and Final Oral Examination (the Dissertation Defense)

Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. Each student is required to conduct an original and independent research project which adds to nursing's body of knowledge, and to communicate the research report in a written dissertation. A written dissertation proposal is required and must be approved at a proposal hearing by a majority vote of the student's Ph.D. committee. A majority vote is also required for approval of the completed written dissertation at the Final Oral Examination (the dissertation defense). The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Titles

Dual-Title Ph.D. in Nursing and Bioethics

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Nursing Ph.D. students may pursue additional training in bioethics through the dual-title Ph.D. program in Bioethics. Students must apply and be admitted to the graduate program in Nursing and the Graduate School before they can apply for admission to the dual-title degree program. Admission to the dual-title is determined upon review of all application materials (forwarded from the College of Nursing) by the admissions committee in Bioethics. Refer to the Admissions Requirements section of the Bioethics Bulletin page. (<https://bulletins.psu.edu/graduate/programs/majors/bioethics/>) Students must apply and be admitted to the dual-title degree program in Bioethics prior to taking the qualifying exam.

To qualify for the dual-title degree, students must satisfy the requirements of the Nursing Ph.D. program. In addition, they must satisfy the requirements described below, as established by the Bioethics program committee. Refer to the Degree Requirements section of the Bioethics Bulletin page. (<https://bulletins.psu.edu/graduate/programs/majors/bioethics/>) Within this framework, final course selection is determined by the student, their Nursing adviser, and their Bioethics program adviser.

The dual-title Ph.D. in Nursing and Bioethics requires a minimum of 1 credit of course work beyond the requirements for the Ph.D. in Nursing (17 credits of the 18 Bioethics credits are part of the current degree requirements in Nursing), as follows:

Code	Title	Credits
Required Courses ¹		
BIOET 501	Perspectives and Methods in Bioethics	3
BIOET 502	Perspectives in Macro-Bioethics	3
BIOET 590	Bioethics Colloquium	1
At least 3 additional BIOET credits at the 500 level.		3
Electives		
8 additional credits from a list of approved electives at the 400 or 500 level, at least two of these courses must be at the 500 level. ²		8
Total Credits		18

¹ These credits can be applied to the Courses for Individual Specialty requirement for the Nursing Ph.D.

² Many of the available electives that students may wish to take are 3-credit courses, so 9 additional credits may be a more typical number for most students. The list of elective courses will be maintained by the Director of the Bioethics Graduate Program in consultation with the Bioethics Program Committee. The Nursing Science core constitutes 7 of these elective credits.

Qualifying Examination

Students must meet the Ph.D. qualifying examination requirements specified by Nursing; a single qualifying examination will be administered that includes assessment of both Nursing and Bioethics. At least one member of the qualifying examination committee must have a Graduate Faculty appointment in Bioethics. Because students must first be admitted to a graduate major program of study before they may apply to and be considered for admission into a dual-title graduate degree program, dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

Comprehensive Examination

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Nursing and Bioethics dual-title Ph.D. student must include at least one member of the Bioethics Graduate Faculty. Graduate faculty members who hold appointments in both programs may serve in a combined role. If the chair of the committee representing Nursing is not also a member of the Graduate Faculty in Bioethics, the member of the committee representing Bioethics must be appointed as co-chair. The faculty member (or members) affiliated with the Bioethics Program will be responsible for administering a portion of the comprehensive exam that will require the student to demonstrate an understanding of various theoretical and methodological approaches to bioethics, and an ability to apply them to issues and problems (including, where appropriate, practical problems) in their nursing.

Dissertation and Final Oral Examination (the Dissertation Defense)

Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. Students enrolled in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and expertise in Nursing and Bioethics. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title Ph.D. in Nursing and Clinical and Translational Sciences

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Nursing Ph.D. students may pursue additional training in CTS through the dual-title Ph.D. program in CTS. Students must apply and be admitted to the graduate program in Nursing and the Graduate School before they can apply for admission to the dual-title degree program. Admission to the dual-title is determined upon review of all application materials (forwarded from the College of Nursing) by the admissions committee in CTS. Refer to the Admission Requirements section of the Clinical and Translational Sciences Bulletin page. (<https://bulletins.psu.edu/>)

graduate/programs/majors/clinical-translational-sciences/) Students must apply and be admitted to the dual-title degree program in CTS prior to taking the qualifying exam.

To qualify for the dual-title degree, students must satisfy the requirements of the Nursing Ph.D. program. In addition, they must satisfy the requirements described below, as established by the CTS program committee. Refer to the Degree Requirements section of the Clinical and Translational Sciences Bulletin page. (<https://bulletins.psu.edu/graduate/programs/majors/clinical-translational-sciences/>) Within this framework, final course selection is determined by the student, their Nursing adviser, and their CTS program adviser.

The CTS dual-title requires 26 credits:

Code	Title	Credits
Required Courses		
CTS 590	Colloquium	2
Select 6 credits from the following:		6
CTS 595A	Clinical Science Internship	
CTS 595B	Translational Science Internship	
BMS 571	Graduate Clinical Rotation	
Electives		
18 credits from a list of approved electives in each of the following areas (at least half of which must be at the 500 or 800 level):		
Statistics		3
Epidemiology		3
Bioinformatics		3
Experimental Design and Interpretation		3
Regulatory Environment		3
Scientific Communication		3
Total Credits		26

Of the 18 elective credits required, 12 credits can be double-counted from the required courses for the Ph.D. in Nursing: STAT 500/PHS 520 meets the 3-credit requirement for Statistics, and an additional 9 credits of Individual Specialization Coursework required for Nursing can be selected from the list of CTS approved electives to meet the 3-credit requirements in Epidemiology, Bioinformatics, and The Regulatory Environment. Therefore, dual-title Ph.D. students in Nursing and CTS may require a minimum of 14 credits of additional course work, consisting of approved electives in Experimental Design and Interpretation (3 cr.) and Scientific Communication (3 cr.), 2 credits of CTS 590; and 6 credits of CTS 595A, CTS 595B, or BMS 571.

Qualifying Examination

Students must meet the Ph.D. qualifying examination requirements specified by Nursing; a single qualifying examination will be administered that includes assessment of both Nursing and CTS. At least one member of the qualifying examination committee must have a Graduate Faculty appointment in CTS. Because students must first be admitted to a graduate major program of study before they may apply to and be considered for admission into a dual-title graduate degree program, dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

Comprehensive Examination

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Nursing and CTS dual-title Ph.D. student must include at least one member of the CTS Graduate Faculty. Graduate Faculty members who hold appointments in both programs may serve in a combined role. If the chair of the committee representing Nursing is not also a member of the Graduate Faculty in CTS, the member of the committee representing CTS must be appointed as co-chair. The faculty member (or members) affiliated with the CTS Program will be responsible for administering a portion of the comprehensive exam that will require the student to demonstrate an understanding of various theoretical and methodological approaches to CTS, and an ability to apply them to issues and problems (including, where appropriate, practical problems) in their nursing.

Dissertation and Final Oral Examination (the Dissertation Defense)

Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. Students enrolled in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their dissertation research and expertise in Nursing and CTS. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://>

www.worldcampus.psu.edu/tuition-and-financial-aid/) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Nursing (NURS) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/nurs/>)

Learning Outcomes

Master of Science in Nursing (M.S.N.)

1. Lead change to improve quality outcomes (KNOW, APPLY/CREATE)
2. Advance a culture of excellence through lifelong learning (PROFESSIONAL PRACTICE)
3. Build and lead collaborative interprofessional care teams (APPLY/CREATE, COMMUNICATE, THINK)
4. Navigate and integrate care services across the healthcare systems (KNOW, APPLY/CREATE).
5. Design innovative nursing practices (APPLY/CREATE)
6. Translate evidence into practice (APPLY/CREATE)
7. Demonstrate option-specific competencies based on the national guidelines (KNOW, APPLY/CREATE, COMMUNICATE)

Doctor of Nursing Practice (D.N.P.)

1. Lead change through transformational leadership to improve health and healthcare outcomes. (THINK)
2. Lead as highly qualified advanced practice nurses to promote the translation of research into practice and deliver expert nursing care. (APPLY/CREATE)
3. Build and Lead collaborative interprofessional care teams. (COMMUNICATE)
4. Advance a culture of excellence through lifelong learning (PROFESSIONAL PRACTICE)
5. Demonstrate option-specific competencies based on the national guidelines for the role (KNOW)
 - a. FNP (Family/Individual across the Lifespan): National Organization of Nurse Practitioner Faculties (2022). Population-Focused Nurse Practitioner Competencies; National Organization of Nurse Practitioner Faculties. NP Core Competencies (2022).
 - b. AGPCNP. National Organization of Nurse Practitioner Faculties (2016). Adult-Gerontology b. Primary Care Nurse Practitioner Competencies; National Organization of Nurse Practitioner Faculties, NP Core Competencies (2022).
 - c. AGACNP. National Organization of Nurse Practitioner Faculties (2022). Adult-Gerontology Acute Care Nurse Practitioner Competencies; National Organization of Nurse Practitioner Faculties, NP Core Competencies (2022).
 - d. Leadership: American Organization of Nurse Executives (AONE), American Organization of Nurse Leaders, Nurse Executive Competencies (2022).
 - e. PMHNP. National Organization of Nurse Practitioner Faculties (2022). Psychiatric Mental Health Nurse Practitioner

Competencies: National Organization of Nurse Practitioner Faculties, NP Core Competencies (2022).

Doctor of Philosophy (Ph.D.)

1. Demonstrate appropriate breadth and depth of scientific knowledge, and comprehension of the major issues of the discipline of nursing (KNOW)
2. Design and conduct research according to scientific principles to create new knowledge (APPLY/CREATE)
3. Demonstrate effective teaching and communication skills for dissemination of scientific knowledge to appropriate stakeholders (KNOW, COMMUNICATE)
4. Advance science through interdisciplinary collaboration to improve the health of individuals, families, and communities (APPLY/CREATE, COMMUNICATE, THINK).
5. Lead the discipline of nursing to influence change and practice, education, policy, and research in accordance with the highest ethical standards. (PROFESSIONAL PRACTICE)

Professional Licensure/Certification

Many U.S. states and territories require professional licensure/certification to be employed. If you plan to pursue employment in a licensed profession after completing this program, please visit the Professional Licensure/Certification Disclosures by State (<https://www.psu.edu/state-licensure-disclosures/>) interactive map.

Contact

Campus	University Park
Graduate Program Head	Judith E Hupcey
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Sheri Matter
Program Contact	Cassidy Shull 201 Nursing Sciences Building University Park PA 16802 crh5490@psu.edu (814) 865-0368
Program Website	View (https://www.nursing.psu.edu/)
Campus	World Campus
Graduate Program Head	Judith E Hupcey
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Sheri Matter
Program Contact	Cassidy Shull 201 Nursing Sciences Building University Park PA 16802 crh5490@psu.edu (814) 865-0368
Program Website	View (https://www.nursing.psu.edu/)

Nutritional Sciences

Graduate Program Head	Meg Bruening
Program Code	NUTR
Campus(es)	University Park (Ph.D., M.S.) World Campus (M.P.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Master of Professional Studies (M.P.S.) Dual-Title Ph.D. in Nutritional Sciences and Clinical and Translational Science Dual-Title Ph.D. in Nutritional Sciences and Social and Behavioral Neuroscience Integrated B.S. in Nutritional Sciences and M.P.S. in Nutritional Sciences
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=NUTR)

PH.D., M.S., DUAL-TITLE PH.D. (NUTRITIONAL SCIENCES AND CLINICAL AND TRANSLATIONAL SCIENCES or SOCIAL AND BEHAVIORAL NEUROSCIENCE)

Graduates of the M.S. and Ph.D. programs are prepared for careers in basic and applied research in nutrition and in college teaching. The course of study is planned to meet the professional objectives of the individual student. Students may emphasize molecular and cellular nutritional sciences, nutritional biochemistry, applied human nutrition, applied animal nutrition, nutrition education, and nutrition in public health. Supporting courses are available in biochemistry, physiology, genetics, microbiology, biophysics, food science, health policy and administration, human development and family studies, anthropology, sociology, psychology, public health sciences, and statistics.

Current research emphasizes minerals, vitamins, lipid metabolism, metabolic disorders, nutrition and behavior, nutrition education strategies, evaluation of dietary intake and nutritional status, nutrition policy and health promotion and disease prevention across the life cycle.

Facilities include well-equipped nutrition science laboratories with animal facilities supervised by a University laboratory animal resource staff. The Diet Assessment Center and the metabolic kitchens serve as laboratories for students in community nutrition, nutrition education, and metabolic nutrition.

M.P.S.

The online professional master's degree (M.P.S.) is designed for those seeking to become registered dietitians, for those already registered and interested in enhancing their careers, and for those interested in pursuing a career with a focus in Nutritional Sciences. Graduates of the program may expect to become leaders on the health care team and other practice teams, and share their knowledge and expertise with other health care professionals and colleagues. Graduates will be positioned for career success and will be innovators in today's dynamic health and wellness sector.

The M.P.S. degree is also offered with an experiential learning track that requires additional course work. Upon completion of the experiential learning track, students will receive a Verification Statement which qualifies them to take the Registered Dietitian Nutritionist credentialing examination.

This is a supervised experiential learning track of the M.P.S. degree program. This track requires that the student complete an additional 9 credits for a total of 39 credits and includes an experiential learning component (6 credits) integrated with the coursework. Three credits of coursework for the Experiential Learning Track of the M.P.S. are online and 6 credits of the coursework are in residence at either the Hershey, PA or University Park, PA and remote/distance geographical locations. Remote geographic locations require students to obtain preceptors/sites in the geographical location in which they reside. These preceptors/sites must be approved by the program prior to admission.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Master of Professional Studies (M.P.S.)

Scores from the Graduate Record Examinations (GRE) are not required for admission.

College graduates with an undergraduate degree in nutrition, dietetics, public health or related health sciences will be considered for admission. Applicants should have a minimum grade-point average of 3.00 (on a 4.00 scale) and three supporting recommendations. Exceptions may be made for students with special backgrounds, abilities, and interests at the discretion of the program. When openings are limited, the best-qualified candidates are given priority.

The basic expectations for admission from undergraduate studies include:

- 3 credits in physiology (or 6 credits in Anatomy & Physiology I and II),
- 3 credits in biochemistry,
- 3 credits in organic chemistry,
- 3 credits in introductory nutrition (equivalent to or more advanced than NUTR 251 at Penn State), and
- 3 credits in advanced nutrition.

If these courses were taken more than 10 years prior to application, they may be accepted at the Programs Director's discretion. Students can be provisionally admitted (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/provisional-admission/>) to the program without these basic expectations, but they must complete all identified deficiencies with a 3.00 grade-point average or above on a 4.0 scale within the first two semesters after acceptance, prior to beginning graduate course work.

Experiential Track of the M.P.S. Program

College graduates with an undergraduate degree in nutrition, dietetics, public health or related health sciences will be considered for admission. Applicants should have a minimum grade-point average of 3.00 (on a 4.00 scale) and three supporting recommendations. Exceptions may be made for students with special backgrounds, abilities, and interests at the

discretion of the program. Scores from the Graduate Record Examination (GRE) are not required for admission.

The basic expectations for admission to the Experiential Track from undergraduate studies include:

- 3 credits in physiology (or 6 credits in Anatomy & Physiology I and II),
- 3 credits in biochemistry,
- 3 credits in organic chemistry,
- 3 credits in introductory nutrition (equivalent to or more advanced than NUTR 251 at Penn State),
- 3 credits in Lifecycle Nutrition,
- 3 credits in Nutrient Metabolism (macronutrient and micronutrient), and
- 3 credits in Medical Nutrition Therapy.

In addition, students must have a total of 500 hours of appropriately documented work or volunteer experience completed within two years of application. Of the 500 hours, 300 hours must be in a nutrition or dietetics-related field.

If any of these courses were completed more than 10 years prior to application, they may be accepted at the Program Director's discretion. The exception is if Medical Nutrition Therapy was taken more than 5 years prior to application, it may be accepted at Program Director's discretion.

For students with a bachelor's degree from an ACEND accredited Didactic Program in Dietetics (DPD), a DPD Verification Statement is required for admission into the Experiential Track of the graduate program.

Students can be provisionally admitted to the Experiential Track of the M.P.S. program without these basic expectations, but they must complete all identified deficiencies with a B grade (3.00 on a 4.0 scale) within the first two semesters after acceptance, prior to taking the following courses: NUTR 800 Food Systems and Organization Management and NUTR 895A, NUTR 895B and NUTR 895C. Students previously matriculated in the M.P.S. program (graduate degree only) must complete an Assessment of Prior Learning form before enrolling in NUTR 895A, NUTR 895B, or NUTR 895C.

Additional Admission Requirements for Remote Location Students

Students must secure sites and preceptors in the remote location prior to admission to the program. The secured sites and preceptors must have prior approval by the program before official admission is granted. Supervised Experiential Learning (SEL) Plan of Study (POS) form must be submitted with Graduate School application.

Master of Science (M.S.) and Doctor of Philosophy (Ph.D.)

Scores from the Graduate Record Examinations (GRE), or from the Medical College Admission Test (MCAT), are required for admission. At the discretion of the graduate program, the GRE or other test scores may be waived for an individual on a case-by-case basis.

College graduates with an undergraduate degree in nutrition, animal sciences, food science, dietetics, or a related biological or social science will be considered for admission. Applicants should have a minimum grade-point average of 3.00 (on a 4.00 scale), an acceptable score on the GRE (an average quantitative and verbal score above the fiftieth percentile), and three supporting recommendations. Exceptions may be made at the discretion of the program for students with special

backgrounds, abilities, and interests. When openings are limited, the best-qualified applicants are given priority.

The basic expectations for admission from undergraduate studies include: 6 credits in chemistry (organic and inorganic); 3 credits each in physiology, biochemistry, and nutrition; and physics, calculus, and analytical chemistry for some research areas in nutrition science, and social science for public health and community nutrition. Students with more than 8 credits of deficiency and a superior record may be provisionally admitted (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/provisional-admission/>) to the graduate degree program. The deficiencies identified must be made up with a 3.00 grade-point average or better within the first two semesters.

Degree Requirements

Master of Professional Studies (M.P.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The program can be completed on a full-time basis in 24 months or students may elect to complete the program on a part-time basis. Requirements for the completion of the Master of Professional Studies in Nutritional Sciences degree include 30 credits at the 500 and 800 level, with a minimum of 6 credits of 500-level course work:

Code	Title	Credits
Required Courses		
NUTR 805	Advanced Nutrient Metabolism	4
NUTR 540	Research Methods	3
NUTR 801	Leadership in the Nutrition Profession	2
NUTR 810	Nutritional Assessment and Diagnosis	3
NUTR 820	Advanced Clinical Nutrition	3
NUTR 830	Advanced Nutrition and Health Program Planning	3
NUTR 840	Advanced Nutrition Counseling	3
NUTR 850	Leadership Concepts and Application for the Nutrition Professional	3
STAT 500 or STAT 800	Applied Statistics Applied Research Methods	3
Culminating Experience		
NUTR 860	Capstone Project in Nutritional Sciences	3
Total Credits		30

All students must enroll in NUTR 860 (<https://bulletins.psu.edu/search/?P=NUTR%20860>) and successfully complete the Capstone Project in order to earn the M.P.S. degree. Depending on the nature of the proposed Capstone Project, the program will approve between 2 and 5 credits of NUTR 860 (<https://bulletins.psu.edu/search/?P=NUTR%20860>) to count towards the degree requirements for a total of 30 credits (minimum). Elective credits may be chosen from a list of approved electives maintained by the program office.

Experiential Track of the M.P.S. Program

Upon completion of the Experiential Learning track of the M.P.S. degree program, students will receive a Verification Statement which qualifies them to take the Registered Dietitian Nutritionist credentialing examination.

In addition to the 30 credits, as described above for the M.P.S. degree, students accepted into the Experiential Track of the M.P.S. Program will be required to take the following additional courses:

Code	Title	Credits
Required Courses		
NUTR 800	Food Systems and Organization Management	3
NUTR 895A	Internship-Clinical	2
NUTR 895B	Internship-Food Systems and Organization Management	2
NUTR 895C	Internship-Community	2
Total Credits		9

The total number of credits required for completion of the Experiential Track of the M.P.S. Program is 39 credits (minimum).

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The graduate program in Nutritional Sciences offers the M.S. degree with an emphasis in basic nutritional sciences, applied human nutrition, or nutrition in public health. The M.S. degree requires a minimum of 30 credits of course work at the 400, 500, 600, or 800 level, including at least 12 credits in 500-level courses and 6 credits in thesis research (NUTR 600 or NUTR 610).

Code	Title	Credits
Required Courses		
NUTR 501	Regulation of Nutrient Metabolism I	4
NUTR 502	Regulation of Nutrient Metabolism II	3
NUTR 520	Readings in Nutrition	2
NUTR 551	Seminar in Nutrition	1
4 additional credits at the 500 level from a list maintained by the program		4
Supporting Courses		
ENGL 418	Advanced Technical Writing and Editing (or equivalent)	3
3 credits in Statistics		3
Electives		
Elective credits may be chosen from a list of approved electives maintained by the program office. Students pursuing an M.S. degree with an emphasis in nutrition and public health are required to complete a 4-credit field experience.		4
Culminating Experience		
NUTR 600 or NUTR 610	Thesis Research Thesis Research Off Campus	6
Total Credits		30

Students must write and defend a master's thesis accepted by the advisers and committee members, the head of the graduate program, and the Graduate School, and the student must pass a thesis defense.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The Ph.D. requires a minimum of 30 credits of course work at the 400, 500, 600, or 800 level, including 18 credits in the following core required courses:

Code	Title	Credits
Required Courses		
NUTR 501	Regulation of Nutrient Metabolism I	4
NUTR 502	Regulation of Nutrient Metabolism II	3
NUTR 503	Nutritional Epidemiology	3
NUTR 520	Readings in Nutrition (taken twice)	1
NUTR 551	Seminar in Nutrition (taken twice)	1
4 additional credits at the 500 level from a list maintained by the program		4
Electives		
12 elective credits chosen in consultation with advisers and Ph.D. committee, from a list of approved electives maintained by the program office		12
Total Credits		30

Students must also attend a weekly colloquium seminar for their entire time in the program. All doctoral students must serve as a teaching assistant for two semesters.

Students must pass a qualifying examination designed to assess the student's potential and academic preparation for doctoral study. Qualifying examinations must be scheduled in compliance with Graduate Council policy (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-604-qualifying-examination-research-doctorate/>). For students with a master's degree, the qualifying examination must be scheduled prior to earning 24 graduate credits or prior to completing 3 semesters following admission to the graduate program, whichever comes first. The qualifying examination is administered and evaluated by the Graduate Qualifying Examination Committee. After completion of the qualifying examination, each student will form a Ph.D. committee comprised of Graduate Faculty internal and external to the Graduate Program in Nutritional Sciences, in accordance with Graduate Council requirements (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>). Students must pass a comprehensive examination, the specific format and content of which is determined in consultation with the Ph.D. committee after which they must write and present a dissertation proposal which needs to be approved by their Ph.D. committee. The writing of a satisfactory dissertation accepted by the Ph.D. committee, the graduate program PIC, and the Graduate School along with passing of the final oral examination (the defense) in Nutritional Sciences, is required.

English Competence

Written and oral English competency will be determined by the qualifying examination committee and remediation assigned, if necessary. Competence must be formally attested by the program before the doctoral student's comprehensive examination is scheduled.

Dual-Titles

Dual-Title Ph.D. Degree in Nutritional Sciences and Clinical and Translational Sciences

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

This dual-title degree program emphasizes interdisciplinary scholarship at the interface of basic sciences, clinical sciences, and human health. Students in the dual-title program are required to either have two advisers from separate disciplines: one individual serving as the primary adviser in the Graduate Program in Nutritional Sciences and another individual serving as the secondary adviser in an area covered by the dual-title program who is a member of the Clinical and Translational Sciences faculty; or if the student's advisor is a member of the Clinical and Translational Sciences faculty, s/he may fulfill both roles.

Doctoral students with research and educational interests in clinical and translational science may apply for the Dual-Title Ph.D. Degree in Nutritional Sciences and Clinical and Translational Sciences following admission to the Graduate School and Nutritional Sciences and prior to taking the qualifying examination in Nutritional Sciences. An admissions committee comprised of faculty affiliated with the dual-title program will evaluate applicants. Applicants must have a graduate GPA of at least 3.5 in a research area related to human health. Prospective dual-title program students will write a statement of purpose that addresses the ways in which their research and professional goals will be enhanced by an interdisciplinary course of study in clinical and translational sciences.

Students must apply and be admitted to the graduate program in Nutritional Sciences and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Clinical and Translational Sciences dual-title program. Refer to the Admission Requirements section of the Clinical and Translational Sciences Bulletin page (p. 204). Doctoral students must be admitted into the dual-title degree program in Clinical and Translational Sciences prior to taking the qualifying examination in their home department.

To qualify for the dual-title degree, students must satisfy the degree requirements for the Ph.D. in Nutritional Sciences. In addition, students pursuing the dual-title Ph.D. in Nutritional Sciences and Clinical and Translational Sciences must complete the degree requirements for the dual-title Ph.D. in Clinical and Translational Sciences, listed on the Clinical and Translational Sciences Bulletin page (p. 204). Approximately 12 credits of course work required for the CTS dual-title may also be counted as required elective courses for the Ph.D. in Nutritional Sciences.

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Nutritional Sciences and must include at least one Graduate Faculty member from the Clinical and Translational Sciences program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Nutritional Sciences and Clinical and Translational Sciences. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Nutritional Sciences and Clinical and Translational Sciences dual-title Ph.D. student must include at least one member of the Clinical and Translational Sciences Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Clinical and Translational

Sciences, the member of the committee representing Clinical and Translational Sciences must be appointed as co-chair. The Clinical and Translational Sciences representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Nutritional Sciences and Clinical and Translational Sciences. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title Ph.D. Degree in Nutritional Sciences and Social and Behavioral Neuroscience

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

This dual-title degree program emphasizes the study of how brain development and function influence, and are influenced by, social, environmental, and behavioral variables. The dual-title Ph.D. program provides students with additional training in an integrative neuroscience program in order to enable them to pursue innovative interdisciplinary research with intellectual sophistication. Students in the dual-title program are required to either have two advisors from separate disciplines: one individual serving as the primary advisor in the Graduate Program in Nutritional Sciences and another individual serving as the secondary advisor in an area covered by the dual-title program who is a member of the Social and Behavioral Neuroscience (SBN) faculty; or if the student's advisor is a member of the SBN faculty, s/he may fulfill both roles.

Doctoral students with research and educational interests in social and behavioral neuroscience may apply for the Dual-Title Ph.D. Degree in Nutritional Sciences and Social and Behavioral Neuroscience following admission to the Graduate School and Nutritional Sciences and prior to taking the qualifying examination in Nutritional Sciences. An admissions committee comprised of faculty affiliated with the dual-title program will evaluate applicants. Prospective dual-title program students will write a letter of application that addresses the ways in which their research and professional goals will be enhanced by an interdisciplinary course of study in social and behavioral neuroscience.

Students must apply and be admitted to the graduate program in Nutritional Sciences and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Social and Behavioral Neuroscience dual-title program. Refer to the Admission Requirements section of the Social and Behavioral Neuroscience bulletin page. Doctoral students must be admitted into the dual-title degree program in Social and Behavioral Neuroscience prior to taking the qualifying examination in their home department.

To qualify for the dual-title degree, students must satisfy the degree requirements for the Ph.D. in Nutritional Sciences. In addition, students pursuing the dual-title Ph.D. in Nutritional Sciences and Social and Behavioral Neuroscience must complete the degree requirements for the dual-title Ph.D. in Social and Behavioral Neuroscience, listed on the Social

and Behavioral Neuroscience bulletin page. Nine credits of course work required for the Social and Behavioral Neuroscience dual-title may also be counted as required elective courses for the Ph.D. in Nutritional Sciences.

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Nutritional Sciences and must include at least one Graduate Faculty member from the Social and Behavioral Neuroscience program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Nutritional Sciences and Social and Behavioral Neuroscience. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees, the Ph.D. committee of a Nutritional Sciences and Social and Behavioral Neuroscience dual-title Ph.D. student must include at least one member of the Social and Behavioral Neuroscience Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Social and Behavioral Neuroscience, the member of the committee representing Social and Behavioral Neuroscience must be appointed as co-chair. The Social and Behavioral Neuroscience representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Nutritional Sciences and Social and Behavioral Neuroscience. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Integrated Undergrad-Grad Programs

INTEGRATED B.S. in Nutritional sciences AND m.p.s. in nutritional sciences

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Nutritional Sciences with the M.P.S. in Nutritional Sciences offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- World Campus

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

ADMISSION REQUIREMENTS

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate->

admissions/how-to-apply/). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The following credentials will be considered for admission:

- IUG Plan of Study
- Resume
- Personal statement of interests and goals
- Three letters of recommendation (must include one letter from the student's undergraduate academic advisor that proves the academic advisor has worked with the student to develop a Plan of Study)
- Official transcripts from all colleges and universities attended
- Minimum GPA of 3.25

Students must apply to the program via the Graduate School application for admission (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet all the admission requirements of the Graduate School and the Nutritional Sciences graduate program for the Master of Professional Studies degree, which are listed on the Admission Requirements tab. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.

In consultation with an adviser, students must prepare a Plan of Study appropriate to this integrated program and must present their Plan of Study to the head of the graduate program or the appropriate committee overseeing the integrated program prior to being admitted to the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.

DEGREE REQUIREMENTS

Students admitted to the B.S. in Nutritional Sciences/M.P.S. are able to earn both the B.S. and M.P.S. in five calendar years of full-time academic study.

Students must fulfill all degree requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Science in Nutritional Sciences are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/colleges/health-human-development/nutritional-sciences-bs/>) Degree requirements for the Master of Professional Studies in Nutritional Sciences degree are listed on the Degree Requirements tab in the Graduate Bulletin (<https://bulletins.psu.edu/graduate/programs/majors/nutritional-sciences/#degreerequirementstext>). Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate commencement. If students accepted into the IUG program are unable to complete the M.P.S. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degree. A minimum of 50% of the double-counted credits must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
NUTR 801	Leadership in the Nutrition Profession	2
NUTR 810	Nutritional Assessment and Diagnosis	3
NUTR 830	Advanced Nutrition and Health Program Planning	3
NUTR 840	Advanced Nutrition Counseling	3
NUTR 850	Leadership Concepts and Application for the Nutrition Professional	3

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Graduate assistantships are only available for students in the M.S. and Ph.D. degree programs.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Nutrition (NUTR) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/nutr/>)

Learning Outcomes

Master of Professional Studies (M.P.S.)

1. **Know:** Graduates will demonstrate knowledge of advanced principles of food and nutrition while incorporating primary literature in the application of nutrition in practice. The core knowledge demonstration will include comprehension of current evidence in the field and an understanding of metabolism, nutrition assessment, clinical nutrition, nutrition counseling, nutrition education and program planning, research, and leadership.
2. **Apply/Create:** Graduates will be able to analyze and synthesize the research findings and the skills to translate research to best practices in various nutrition practice settings including clinical, research, management, and community. Graduates will demonstrate the ability to evaluate high-quality research to build an evidence base for practice decisions and generate ideas for a novel capstone project. Graduates will be also able to demonstrate the ability to design, implement, and evaluate a capstone project and effectively demonstrate the ability to disseminate their findings to other health care professionals and colleagues.
3. **Communicate:** Graduates will be able to convey ideas, arguments and practice-based decisions in clear, concise, well-organized papers, proposals, videos, posters, and oral presentations.
4. **Critical Thinking:** Graduates will be able to critique and interpret primary food and nutrition literature, consumer nutrition information, and contemporary discourse in the field of nutrition. Critical thinking skills will be demonstrated by the student's ability to analyze, evaluate, interpret, and apply the principles of nutrition assessment, clinical nutrition, nutrition counseling, nutrition education and program planning, research, and leadership in diverse, practical formative and summative assessments.
5. **Professional practice:** Graduates will demonstrate knowledge and comprehension of ethical principles relevant to leadership and professional practice in the field of nutrition and those related to authorship, plagiarism, conflicts of interest, and will develop a breadth and depth of understanding relevant to diversity, equity, inclusion, and belonging. Students will also demonstrate the skills needed to become innovators and leaders in today's dynamic health and wellness sector. These skills include critical thinking, problem solving, collaboration, communication, leadership, cultural humility.

Master of Science (M.S.)

1. **Know:** Students will demonstrate knowledge of the basic principles of nutrition science and an understanding of the primary literature both in basic and applied areas of research. The core demonstration will include comprehension of current knowledge in the field and an understanding of study design, methods, results, and significance and the application of this comprehension/understanding to problems in biology, biochemistry, medicine, and public health.
2. **Apply/Create:** Students will be able to synthesize the research findings in their specialty area and generate ideas for a novel research project; they will be able to articulate the rationale for the proposed novel research project and clearly describe a specific hypothesis to be tested; they will demonstrate the ability to use best practices in the field of nutrition science to design a research study to test this hypothesis and carry it to completion.

3. **Communicate:** Students will be able to convey ideas or arguments in clear, concise, well-organized papers and proposals as well as in formal, oral presentations.
4. **Critical thinking:** Students will master the ability to critique the primary nutrition science literature. This will be demonstrated by the student's ability to identify the research question, experimental design and conclusions in a scientific article in the field; they will also be able to apply their knowledge of statistics and experimental design to critique methodology and conclusions in a scientific article in the field.
5. **Professional practice:** Students will demonstrate knowledge and comprehension of research ethics issues which are relevant to the field of nutrition science including working with animal and human populations, ethical principles related to authorship, plagiarism, and conflicts of interest. They will also contribute to the profession through service.

Doctor of Philosophy (Ph.D.)

1. **Know:** Students will demonstrate knowledge of the basic principles of nutrition science and an understanding of the primary literature both in basic and applied areas of research. The core demonstration will include comprehension of current knowledge in the field and an understanding of study design, methods, results, and significance and the application of this comprehension/understanding to problems in biology, biochemistry, medicine, and public health.
2. **Apply/Create:** Students will be able to synthesize the research findings in their specialty area and generate ideas for a novel research project; they will be able to articulate the rationale for the proposed novel research project and clearly describe a specific hypothesis to be tested; they will demonstrate the ability to use best practices in the field of nutrition science to design a research study to test this hypothesis and carry it to completion.
3. **Communicate:** Students will be able to convey ideas or arguments in clear, concise, well-organized papers and proposals as well as in formal, oral presentations.
4. **Critical thinking:** Students will master the ability to critique the primary nutrition science literature. This will be demonstrated by the student's ability to identify the research question, experimental design and conclusions in a scientific article in the field; they will also be able to apply their knowledge of statistics and experimental design to critique methodology and conclusions in a scientific article in the field.
5. **Professional practice:** Students will demonstrate knowledge and comprehension of research ethics issues which are relevant to the field of nutrition science including working with animal and human populations, ethical principles related to authorship, plagiarism, and conflicts of interest. They will also contribute to the profession through service.

Professional Licensure/Certification

Many U.S. states and territories require professional licensure/certification to be employed. If you plan to pursue employment in a licensed profession after completing this program, please visit the Professional Licensure/Certification Disclosures by State (<https://www.psu.edu/state-licensure-disclosures/>) interactive map.

Contact

Campus	University Park
Graduate Program Head	Meg Bruening
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Kristina Petersen
Program Contact	Mary B Balboni 110 Chandlee Laboratory University Park PA 16802-610 mbm145@psu.edu (814) 865-3448
Program Website	View (https://hhd.psu.edu/nutrition/nutritional-sciences-graduate-program/)

Campus	World Campus
Graduate Program Head	Meg Bruening
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Gina Pazzaglia
Program Contact	Mary B Balboni 110 Chandlee Laboratory University Park PA 16802-610 mbm145@psu.edu (814) 865-3448
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-nutritional-sciences-masters-degree/overview/)

Operations Research

Graduate Program Head	Jose A. Ventura
Campus(es)	University Park
Degrees Conferred	Dual-Title
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=OR)

Students electing this option through participating programs earn a degree with a dual-title at both the Ph.D. and the M.S., M.A., or M.Eng. levels, i.e., Ph.D. in (graduate program name) and Operations Research, or M.S., M.A., or M.Eng. in (graduate program name) and Operations Research.

The following graduate programs offer dual-title degrees in Operations Research:

- Agricultural and Biological Engineering
- Biorenewable Systems
- Business Administration
- Chemical Engineering
- Civil Engineering
- Computer Science and Engineering
- Economics
- Electrical Engineering
- Energy, Environmental, and Food Economics
- Energy and Mineral Engineering
- Entomology

- Forest Resources
- Geography
- Geosciences
- Industrial Engineering
- Mathematics
- Statistics
- Workforce Education and Development

The Operations Research dual-title degree program is administered by an Operations Research committee, which is responsible for management of the program. The committee maintains program definition, identifies faculty and courses appropriate to the option, and recommends policy and procedures for its operation to the dean of the Graduate School. This dual-title degree program is offered by graduate major programs in eight colleges. The dual-title program enables students from diverse graduate programs to attain and be identified with the tools, techniques, and methodology of operations research, while maintaining a close association with areas of application. Operations research is the analysis—usually involving mathematical treatment—of a process, problem, or operation to determine its purpose and effectiveness and to gain maximum efficiency.

Admission Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Students must apply and be admitted to one of the approved graduate programs and The Graduate School before they can apply for admission to the dual-title degree program.

For the M.S., M.A., M.Eng. dual-title degree in Operations Research, in addition to those prescribed by the graduate major program, prerequisites for acceptance to the program without deficiency include the following or their equivalent:

Code	Title	Credits
MATH 140	Calculus With Analytic Geometry I	4
MATH 141	Calculus with Analytic Geometry II	4
MATH 220	Matrices	2-3
CMPSC 101	Introduction to Programming	3
	3 credits of probability and statistics	3

For the Ph.D. dual-title degree in Operations Research, in addition to those prescribed by the graduate major program, prerequisites for acceptance to the program without deficiency include the following or their equivalent:

Code	Title	Credits
MATH 401	Introduction to Analysis I	3
MATH 436	Linear Algebra	3
CMPSC 101	Introduction to Programming	3
	3 credits of probability and statistics	3

Doctoral students must apply and be admitted to the Operations Research dual-title program prior to taking the qualifying exam.

Degree Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

To qualify for a dual-title degree, students must satisfy the requirements of the graduate major programs in which they are enrolled, in addition to the minimum requirements, or their equivalent, in the Operations Research program. Students must enroll in OR 590 for at least 1 credit in each year enrolled in the program and in residence.

Master's Degrees

For the M.S. or M.A. dual-title degree in Operations Research, the minimum requirements are:

- 6 credits in stochastic/statistical methods, including a minimum of 3 credits in each of the areas of statistical methods and stochastic processes;
- 6 credits in optimization, including a minimum of 3 credits in linear programming;
- 3 credits in computational methods; and
- 3 credits in applications/specialization. (Application courses are those that involve problem solving through the use of decision methods.)

A minimum of 9 credits must be in the 500 series. Particular courses may satisfy both the graduate major program requirements and those in the Operations Research program. A list of courses that will satisfy these requirements is maintained by the graduate program office.

A thesis may be required by the graduate major program, the supervisor of which must be a member of the Graduate Faculty recommended by the chair of the program granting the degree and approved by the Operations Research committee as qualified to supervise thesis work in operations research. If the graduate major program has an approved non-thesis track for the M.A./M.S. degree, a scholarly paper may be written in lieu of a thesis. All M.Eng. students and M.A./M.S. students who choose to submit a scholarly paper instead of a thesis must take an additional 6 credits in the Operations Research program. It is the prerogative of the graduate major program to assign these credits to one or more of the following categories: stochastic/statistical methods, optimization, computational methods, or applications.

Doctoral Degrees

The minimum requirements for the Ph.D. dual-title degree in Operations Research are:

- 9 credits in stochastic/statistical methods, including a minimum of 3 credits in each of the areas of statistical methods and stochastic processes;
- 9 credits in optimization, including a minimum of 3 credits in linear programming;
- 6 credits in computational methods, including a minimum of 3 credits in simulation; and
- 12 credits in applications/specialization.

A minimum of 18 credits must be in the 500 series, and particular courses may satisfy both the graduate major program requirements and those in the Operations Research program.

The qualifying examination committee for the dual-title Ph.D. degree must include at least one Graduate Faculty member from the Operations Research program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both the primary graduate degree program and Operations Research. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the chair and at least two members of the Ph.D. committee of an Operations Research dual-title Ph.D. student must be members of the Operations Research Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. The Operations Research representatives on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in both their primary graduate program and Operations Research. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor Requirements

Requirements listed here are in addition to requirements for minors in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

A Ph.D. minor program in Operations Research is available for doctoral students who find it advantageous to include advanced quantitative methods of systems analysis in their programs of study and have been approved to do so by their dissertation committees. To qualify for a minor in Operations Research, students must satisfy the requirements of their graduate major programs, meet the same admissions prerequisites as the M.S. dual-title degree students, and meet the following minimum degree requirements: 6 credits in stochastic/statistical methods, including a minimum of 3 credits in each of the areas of statistical methods and stochastic processes; 6 credits in optimization; and 3 credits in computational methods. A minimum of 6 credits must be taken at the 500 level.

Official requests to add the minor to a doctoral student's academic record must be submitted to Graduate Enrollment Services prior to establishment of the dissertation committee and prior to scheduling the comprehensive examination. At least one Graduate Faculty member from Operations Research must serve on the candidate's dissertation committee.

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's

website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Operations Research (OR) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/or/>)

Contact

Campus	University Park
Graduate Program Head	Jose A. Ventura
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Jose A. Ventura
Program Contact	Jose A. Ventura 356 Leonhard Building University Park PA 16802 jav1@psu.edu (814) 865-3841
Program Website	View (http://sites.psu.edu/ieor/)

Organization Development and Change

Graduate Program Head	Susan Land
Program Code	ODC
Campus(es)	World Campus (M.P.S.)
Degrees Conferred	Master of Professional Studies (M.P.S.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=ODC)

The MPS in Organization Development and Change (MPS-OD&C) is an online program of study designed for professionals working primarily in organization change and workforce development related careers.

The program will highlight the changing nature of the field of Organization Development, including the impact of the globalization of private and public organizations and the growing importance of organization change and development in the workforce. It will culminate in a field-based project course in which students will demonstrate their understanding of the curriculum and apply it to their professional areas of interest. Students will be expected to complete an organization development-related project and are encouraged to solicit project ideas from a work-related environment to ensure that the problems or opportunities they identify are grounded in the reality of organization development. Upon completion of the MPS-OD&C degree, students will be equipped to work as professionals in corporate development, talent development, workforce development, performance improvement, training and

development, and with private employers, government agencies, and non-profit organizations.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Applicants to the MPS-OD&C must submit the following materials:

- Penn State Graduate School application form (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) and nonrefundable application fee
- World Campus program application
- A statement of career and educational goals including documentation of a minimum of two years of related full-time work. The statement should be an essay (2-3 pages in length) that demonstrates the applicant's written communication skills. A resume should be attached as a supplement.
- Three letters of recommendation that attest to the applicant's readiness for graduate study and that he or she has the requisite minimum of two years of work experience
- Official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>)
- TOEFL score, if applicable

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Admissions decisions for the program are based on the quality of the applicant's credentials. The decisions are based on a review of the complete application portfolio. During the admission process, students who appear to be better suited for another graduate level program will be encouraged to apply to the appropriate program. Graduate Record Examination (GRE) scores are not required.

Degree Requirements

Master of Professional Studies (M.P.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The MPS in OD&C is conferred upon students who earn a minimum of 30 credits of course work at the 400, 500, or 800 level while maintaining a grade-point average of 3.0 or better in all course work, including at least 18 credits at the 500 or 800 level (with at least 6 credits at the 500 level), and who complete a quality culminating field-based capstone project in consultation with a graduate adviser. The program curriculum includes:

- Required courses (15 credits; five core courses)
- Electives (12 credits; select courses aligned with student's career interests)
- Required culminating capstone project (3-credits)

In the 30-credit program, students obtain a critical knowledge base in organization development, appreciative inquiry, collaborative engagement, and change leadership. The curriculum includes five core courses, four elective courses, and one required field-based capstone in which students identify an organization development related project related to their career interests in business, industry, or government and carry out a practical problem analysis and resolutions effort.

As students progress through the courses, they can gain new skills to apply immediately in their current work environment to help improve their organization's effectiveness. Their course projects will regularly draw from work-related environments to ensure that the concepts they are building on are grounded in the reality of organization development.

Code	Title	Credits
Required Courses ¹		
WFED 572	Foundations in Organization Development and Change	3
WFED 578	Process Consultation in Organization Development	3
WFED 582	Assessing Data: Organizational Diagnosis	3
WFED 884	Appreciative Inquiry	3
WFED 880	Facilitating Groups and Teams	3
Electives		
Select four elective courses ²		12
Culminating Experience		
WFED 595A	Field Based Project for Workforce Development Professionals (Capstone Project)	3
Total Credits		30

¹ Substitutions for the prescribed core courses, either with resident-instruction courses, alternate online courses, or courses from other institutions, will be considered on a case-by-case basis, and must be petitioned and approved by the program coordinator, with input from the student's graduate adviser.

² Elective courses can be taken at any time during degree progression. Students will need to obtain prior approval from their academic adviser before taking any 400-, 500-, or 800-level courses outside of the pre-approved electives. Students may also be able to transfer credits into the program, in consultation with their academic adviser and subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>). An extensive variety of elective courses are available; the most current list is maintained by the program office. An extensive variety of pre-approved elective courses are available; the most current list is maintained by the program office. Electives will include 6-12 credits that comprise a concentration. Students may bundle electives into one or more 6-12 credit concentration areas. However, students may complete this degree program without a concentration.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

No student aid is offered by the MPS-OD&C program.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Workforce Education and Development (WFED) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/wfed/>)

Learning Outcomes

1. KNOW. Graduates will be able to obtain a critical knowledge base in organization development, appreciate inquiry, and change.
2. APPLY. Graduates will be able to use various resources for developing, implementing, evaluating, and marketing organization development programs.
3. COMMUNICATE. Graduates will be able to observe group dynamics, facilitate change efforts, and communicate professional organization development knowledge in written and oral presentation formats in a manner appropriate to the audience.
4. CRITICAL THINKING. Graduates will be able to become an effective organization development practitioner through critical thinking and hands-on experience.
5. PROFESSIONAL PRACTICE. Graduates will be able to address ethical issues in practicing organization development activities, including engagement in professional service to the profession.
6. TEAMWORK. Graduates will be able to observe group dynamics and strategically lead and facilitate both small group and large group change initiatives.

Contact

Campus	World Campus
Graduate Program Head	Susan Land
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Heather Toomey Zimmerman
Program Contact	Whitney A DeShong 303 Keller Building University Park PA 16802 wad5021@psu.edu (814) 865-0473
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/organization-development-change-masters/overview/)

Pathobiology

Graduate Program Head	K. Sandeep Prabhu
Program Code	PATHB
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Dual-Title Ph.D. in Pathobiology and Clinical and Translational Sciences
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=PATHB)

The graduate program in Pathobiology is designed to provide flexibility in graduate work while providing opportunities to study immunology, microbiology, nutrition, biochemistry, virology, veterinary pathology, physiology, or toxicology, usually as related to problems seen in human, domestic animal, and wildlife health.

Graduate instruction is directed by Graduate Faculty members from the Department of Veterinary Science and related units with research interests in animal science, biochemistry, biology, biophysics, immunology, nutrition, physiology, zoology, and others.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Scores from the Graduate Record Examinations (GRE), or from a comparable substitute examination accepted by the Pathobiology graduate program, are required for admission. At the discretion of Pathobiology, a student may be admitted for graduate study in a program without these scores.

Applicants with a 3.0 or better grade-point average (on a 4.00 scale) in undergraduate science courses and appropriate course backgrounds will be considered for admission. Applicants should have a baccalaureate degree in a biological science-related field, or a degree as a graduate veterinarian or equivalent. Undergraduate preparation should include

biology, chemistry, physics, mathematics through calculus, and preferably biostatistics and biochemistry.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

After a student has been admitted to graduate study in the department, an adviser will be appointed by the program director. This person may be a member of the eventual M.S. committee or someone else assigned the responsibility for directing the student's scheduling of course work.

A minimum of 30 credits of coursework at the 400, 500, 600, and 800 levels is required for the M.S. degree, of which at least 18 credits must be taken in 500- and 600-level courses.

Satisfactory completion of the following courses or their equivalent is required of all M.S. degree candidates:

- Statistics, 3 credits;
- Biochemistry or molecular and cell biology, 3 credits (usually chosen from BMB 400 and BMB 501)
- VBSC 520

All Pathobiology students are required to complete one semester of VBSC 590 each year as well as 8 elective credits from a list of courses that is maintained by the Pathobiology program office.

Pathobiology requires no program-specific qualifying examinations, and there is no communication/language requirement for the M.S.

A thesis is required of all candidates for the M.S. degree, including 6 credits of VBSC 600.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The Ph.D. program is designed for completion in three to four academic years. Doctoral students usually complete certain required courses and obtain laboratory experience before selecting an area of specialization and completing an original research problem, including the defense of the Ph.D. dissertation.

After a student has been admitted to graduate study in the department, an adviser will be appointed by the program director. The person may be a member of the eventual Ph.D. committee or someone else designated the responsibility for directing the student's scheduling of course work. The adviser is also responsible for initiating the scheduling of the qualifying examination.

The doctor of philosophy degree places a strong emphasis on research. It is conferred in recognition of the capacity to carry out independent research and the attainment of a high level of scholarship. General requirements for the doctorate specify:

- a minimum period of residence (two semesters, excluding summer sessions, within a 12-month period),
- the passing of a qualifying examination,

- comprehensive and final oral examinations, and
- the writing of a satisfactory dissertation.

The particular combination of courses, seminars, individual study, and research that constitutes an individual student's program is arranged by the Ph.D. committee and should include the courses that have been designated in the Pathobiology graduate curriculum.

The Pathobiology graduate program requires a total of 21 credits of course work at the 400, 500, 600, and 800 level for the Ph.D. degree. A minimum grade-point average of 3.00 for work done at the University is required.

There are formal communications requirements for the Ph.D. degree in Pathobiology that are required by Graduate Council. The Ph.D. committee will assess the technical writing and oral communication skills of the candidate and may require that formal course work or other means to improve these skills be undertaken.

The graduate program in Pathobiology requires that each graduate student have 3 credits in statistics. Ph.D. students in Pathobiology additionally are expected to have statistical skills equivalent to those learned in STAT 501 and STAT 502. In addition, the qualifying examination committee and the Ph.D. committee may require that additional course work in statistics be taken if deficiencies are noted.

A qualifying examination is given to students in the Ph.D. program after they complete at least 18 credits of post-baccalaureate course work.

After passing the qualifying examination, each doctoral student is guided by a Ph.D. committee that meets all Graduate Council requirements (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>).

Dual-Titles

Dual-Title Ph.D. in Pathobiology and Clinical and Translational Sciences

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Doctoral students with research and educational interests in clinical and translational science may apply for the Dual-Title Ph.D. Degree in Pathobiology and Clinical and Translational Sciences (CTS) following admission to the Graduate School and Pathobiology and prior to taking the qualifying examination in Pathobiology. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the CTS dual-title program. Refer to the Admission Requirements section of the CTS Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/clinical-translational-sciences/>).

This dual-title degree program emphasizes interdisciplinary scholarship at the interface of basic sciences, clinical sciences and human health. Students in the dual-title program are required to have two advisers from separate disciplines: one individual serving as the primary mentor in the graduate program in Pathobiology and another individual serving as the secondary mentor in an area covered by the dual-title program who is a member of the CTS faculty.

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Pathobiology. In addition,

students must complete the degree requirements for the dual-title in CTS, listed on the CTS Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/clinical-translational-sciences/>). Up to 6 credits of course work may be double-counted as elective courses to meet the requirements for the Ph.D. in Pathobiology.

For students in the dual-title program, the qualifying examination will include content from both the Graduate Program in Pathobiology and the CTS programs and will be completed with the other Pathobiology students in the third semester. The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Pathobiology and must include at least one Graduate Faculty member from the CTS program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Pathobiology and CTS. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Pathobiology and CTS dual-title Ph.D. student must include at least one member of the CTS Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in CTS, the member of the committee representing CTS must be appointed as co-chair. The CTS representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Pathobiology and CTS. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Veterinary and Biomedical Sciences (VBSC) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/vbsc/>)

Learning Outcomes

Master of Science (M.S.)

1. Know. Graduates will demonstrate specific mastery of core concepts related to molecular mechanisms of disease in humans and animals, as well as evidence-based decision making in general.
2. Research. Graduates will demonstrate ability to create and execute a research plan aimed at understanding disease mechanisms and/or developing disease detection and diagnosis strategies.
3. Communicate. Graduates will demonstrate ability to effectively communicate scientific ideas, proposals, and research findings using both written and oral formats.
4. Analyze. Graduates will demonstrate ability to critically analyze and assess scientific ideas and results related to the area of human/animal disease research.
5. Practice ethically. Graduates will demonstrate knowledge and understanding of core ethical values and right conduct in research, and maintain the highest ethical standards in their own research.

Doctor of Philosophy (Ph.D.)

1. Know. Graduates will demonstrate specific mastery of core concepts related to molecular mechanisms of disease in humans and animals, as well as evidence-based decision making in general.
2. Research. Graduates will demonstrate ability to identify a knowledge gap based on reading and understanding the current scientific literature, to create a research plan that addresses the gap in knowledge, and to execute that research plan so that the result is a meaningful contribution to the understanding of disease mechanisms.
3. Communicate. Graduates will demonstrate ability to effectively communicate scientific ideas, proposals, and research findings using both written and oral formats.
4. Analyze. Graduates will demonstrate ability to critically analyze and assess scientific ideas and results related to the area of human/animal disease research.
5. Practice ethically. Graduates will demonstrate knowledge and understanding of core ethical values and right conduct in research, and maintain the highest ethical standards in their own research.

Contact

Campus	University Park
Graduate Program Head	Kumble Sandeep Prabhu
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Anthony Paul Schmitt
Program Contact	Margaret Ann Weber 107D AVBS Building University Park PA 16802 maw71@psu.edu (814) 865-7697
Program Website	View (http://vbs.psu.edu/graduateprograms/pathobiology/)

Philosophy

Graduate Program Head	Sarah Miller
Program Code	PHIL
Campus(es)	University Park (Ph.D., M.A.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Arts (M.A.) Dual-title Ph.D. in Philosophy and African American and Diaspora Studies Dual-title Ph.D. in Philosophy and Classics and Ancient Mediterranean Studies Dual-title Ph.D. and M.A. in Philosophy and Women's, Gender, and Sexuality Studies
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=PHIL)

Based on its longstanding strengths in continental philosophy and in the history of philosophy (in phenomenology and in early modern up to post-Kantian philosophy), the Penn State Philosophy Doctoral Program focuses on social and political philosophy in the broad sense. Our graduate faculty offer seminars in Plato and Rousseau, but also in the philosophy of race, decolonial philosophy, feminist philosophy, and environmental philosophy. Similarly our graduate faculty offer seminars in ethics, not only in the traditional areas of ethics such as deontology, but also in contemporary forms of ethical theory like care and relational ethics.

The Penn State Philosophy Doctoral Program offers dual-title doctoral degrees in Women's, Gender, and Sexuality Studies, in African American and Diaspora Studies, and in Classics and Mediterranean Studies.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Undergraduate preparation in Philosophy is advisable. Students with a 3.00 junior/senior grade-point average (on a 4.00 scale) and with appropriate course backgrounds will be considered for admission. The best-qualified applicants will be accepted up to the number of spaces that are available for new students. Exceptions to the minimum 3.00

GPA may be made for students with special backgrounds, abilities, and interests at the discretion of the program. The Philosophy Department no longer requires and does not take into consideration GRE scores for the evaluation of applications.

Degree Requirements

Master of Arts (M.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Students receive an M.A. degree as a part of their work for the Ph.D. The M.A. is awarded after successful completion of the qualifying exam, part of which serves as the master's scholarly paper, and after acquiring the minimum 30 credits of courses.

Students awarded an M.A. will have met the following requirements:

1. A minimum of 30 credits including at least 18 credits in 500-level courses.
 - a. At least 18 credits must be in Philosophy. (At least 12 of these credits must be in 400 and 500 level courses).
 - b. 6 credits may be in a Graduate Minor.
2. The submission of a qualifying examination portfolio, a portion of which serves as the master's scholarly paper. The portfolio must be accepted by the qualifying examination committee and the head of the graduate program.
3. Successful completion of the qualifying exam.

The department does not admit applicants for the terminal master's degree.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A minimum of 30 credits in residence at Penn State is required. 18 of these course credits must be at the 500 level in Philosophy. In addition, at least 9 credits must be taken at the 600 level in Philosophy. Students typically take 50 credits of course work and 36 research credits. At the program's discretion, students may take up to 15 non-Philosophy credits toward a doctoral minor.

The foreign language requirement for the Philosophy Ph.D. degree is satisfied either by passing department translation examinations in two languages other than English, or by passing one language examination and PHIL 512 (<https://bulletins.psu.edu/search/?P=PHIL%20512>).

To earn the Ph.D. degree, doctoral students must also write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Titles

Dual-Title Ph.D. in Philosophy and African American and Diaspora Studies

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Students must apply and be admitted to the graduate program in Philosophy and the Graduate School before they can apply for admission to the dual-title degree program. Applicants interested in the dual-title degree program may make their interest known on their applications to Philosophy. Students must apply and be admitted to the dual-title degree program in African American and Diaspora Studies prior to taking the qualifying exam. In addition to the admission requirements set forth by the Graduate Council and the Department of Philosophy, students will be admitted to the dual-title degree program in African American and Diaspora Studies by an admissions committee of African American and Diaspora Studies faculty and must meet the admissions requirements of the African American and Diaspora Studies dual-title program. Refer to the Admission Requirements section of the African American and Diaspora Studies Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/african-american-diaspora-studies/>).

GPA and GRE Requirements

Applicants entering with only an undergraduate degree should have a junior/senior cumulative average of at least 3.00 (on a 4.00 scale), and, where applicable, a minimum GPA of 3.50 for all graduate work previously undertaken. Exceptions to the minimum GPA requirement may be made for students with special backgrounds, abilities, and interests at the discretion of the program. Each applicant must provide the scores of the Graduate Record Examination (GRE) taken within five years previous to the date of application that have already been provided for admission to the graduate major program.

Degree Requirements

To qualify for the dual-title degree in Philosophy and African American and Diaspora Studies, students must satisfy the Philosophy Ph.D. degree requirements listed in the Degree Requirements section. In addition, students must complete the degree requirements for the dual-title in African American and Diaspora Studies, listed on the African American and Diaspora Studies Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/african-american-diaspora-studies/>). The minimum course requirements for this dual-title Ph.D. degree are as follows:

15 credits of course work related to African American and Diaspora Studies, all at the 500 or 800 level. Of these 15 credits, 9 must come from the required core course sequence in African American and Diaspora Studies:

Code	Title	Credits
Required Courses		
AFAM 501	Seminar in African American Studies	3
AFAM 502	Blacks and African Diaspora	3
AFAM 503	Sexual and Gender Politics in the African Diaspora	3
Choose 6 elective credits from the list of approved electives maintained in the African American and Diaspora Studies program office.		6
Total Credits		15

Credits earned at other institutions but not used to earn a degree may be applied toward the requirements for a graduate degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>).

Qualifying Examination

In accordance with Graduate Council policy, the qualifying examination committee must include at least one member of the African American

and Diaspora Studies Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role.

Because students must first be admitted to a graduate major program of study before they may apply to and be considered for admission into a dual-title graduate degree program, dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

The dual-title field must be fully integrated into the qualifying exam for the doctoral program. In addition, students in the dual-title Ph.D. in African American and Diaspora Studies will be required to present to their committee a portfolio of work in African American and Diaspora Studies which includes a statement of the student's interdisciplinary research interests, a program plan, and samples of writing that indicate the student's interest in questions taken up by scholars of African American and Diaspora Studies.

Ph.D. committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Philosophy and African American and Diaspora Studies dual-title doctoral degree student must include at least one member of the African American and Diaspora Studies Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not a member of the Graduate Faculty in African American and Diaspora Studies, the member of the committee representing African American and Diaspora Studies must be appointed as co-chair.

Comprehensive Exams

The African American and Diaspora Studies Graduate Faculty member on the student's committee is responsible for developing and administering the African American and Diaspora Studies portion of the student's comprehensive exams. The exam must incorporate written and oral components in African American and Diaspora Studies based on the student's thematic or regional area of interest and specialization in African American and Diaspora Studies. The African American and Diaspora Studies portion of the exam will include the following components:

- broad history of the field,
- contemporary theory and debates,
- and either sexual and gender politics or
- a topic related to the student's specific area of interest.

Dissertation

The candidate must complete a dissertation and pass a final oral defense of that dissertation on a topic that reflects their original research and education in both Philosophy and African American and Diaspora Studies in order to earn the dual-title Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title Ph.D. in Philosophy and Classics and Ancient Mediterranean Studies

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://>

gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/).

Admission Requirements

Students must apply and be admitted to the graduate program in Philosophy and The Graduate School before they can apply for admission to the dual-title degree program. Applicants interested in the dual-title degree program may make their interest known on their applications to Philosophy. Students must apply and be admitted to the dual-title graduate program in Classics and Ancient Mediterranean Studies prior to taking the qualifying exam. In addition to the admission requirements set forth by the Graduate Council and the Department of Philosophy, students seeking admission to the dual-title program will be admitted to graduate study in CAMS by an admissions committee of CAMS faculty and the approval of the head of CAMS, and must meet the admissions requirements of the Classics and Ancient Mediterranean Studies dual-title program. Refer to the Admission Requirements section of the Classics and Ancient Mediterranean Studies (<http://bulletins.psu.edu/graduate/programs/majors/classics-ancient-mediterranean-studies/>) Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/african-american-diaspora-studies/>).

Applicants to this dual-title degree program should have an academic record that demonstrates expertise in a field relevant to ancient Mediterranean studies and proficiency at an intermediate level (e.g., 3 semesters of study) in one or more ancient languages. Prospective students seeking admission to this dual-title degree program are required to write a statement of purpose that addresses the ways in which their research and professional goals will reflect an interest in interdisciplinary research in the participating program and the disciplines and fields included in CAMS.

GPA and GRE Requirements

Applicants entering with only an undergraduate degree should have a junior/senior cumulative average of at least 3.00 (on a 4.00 scale), and, where applicable, a minimum GPA of 3.50 for all graduate work previously undertaken. Exceptions to the minimum GPA requirement may be made for students with special backgrounds, abilities, and interests at the discretion of the program. Each applicant must provide the scores of the Graduate Record Examination (GRE) taken within five years previous to the date of application that have already been provided for admission to the graduate major program.

Degree Requirements

To qualify for the dual-title degree in Philosophy and Classics and Ancient Mediterranean Studies, students must satisfy the Philosophy Ph.D. degree requirements listed in the Degree Requirements section. In addition, students must complete the degree requirements for the dual-title in Classics and Ancient Mediterranean Studies, listed on the Classics and Ancient Mediterranean Studies (<http://bulletins.psu.edu/graduate/programs/majors/classics-ancient-mediterranean-studies/>) Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/african-american-diaspora-studies/>). The minimum course requirements for this dual-title Ph.D. degree are as follows:

- 15 credits of CAMS-related coursework at the 400 or 500 level.

3 of these credits will come from CAMS 592. At least 3 credits will come from CAMS 593. The remainder may come from CAMS courses or courses relevant to the student's research interests, as approved by the student's doctoral adviser and the CAMS program director of graduate studies. Unless exempted by the student's Ph.D. committee, at least 6 of these credits should be in an ancient language.

Language Requirements

In addition to advanced proficiency in one ancient language, students will be expected to acquire and demonstrate reading proficiency in those modern foreign languages (e.g., but not exclusively, French, German, Italian) appropriate to their research interests, as identified by their Ph.D. committee.

Qualifying Examination

In accordance with Graduate Council policy, the qualifying examination committee must include at least one member of the Classics and Ancient Mediterranean Studies Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role.

Because students must first be admitted to a graduate major program of study before they may apply to and be considered for admission into a dual-title graduate degree program, dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

The dual-title field must be fully integrated into the qualifying exam for the doctoral program. In addition, students in the dual-title Ph.D. in Classics and Ancient Mediterranean Studies will be required to present a portfolio of work in Classics and Ancient Mediterranean Studies which includes a statement of the student's interdisciplinary research interests, a program plan, and samples of writing that indicate the student's work in Classics and Ancient Mediterranean Studies.

Ph.D. committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Philosophy and Classics and Ancient Mediterranean Studies dual-title doctoral degree student must include at least one member of the Classics and Ancient Mediterranean Studies Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not a member of the Graduate Faculty in Classics and Ancient Mediterranean Studies, the member of the committee representing Classics and Ancient Mediterranean Studies must be appointed as co-chair.

Comprehensive Exams

The Classics and Ancient Mediterranean Studies Graduate Faculty member on the student's committee is responsible for developing and administering the Classics and Ancient Mediterranean Studies portion of the student's comprehensive exams. The exam must incorporate written and oral components in Classics and Ancient Mediterranean Studies based on the student's thematic or historical area of interest and specialization in Classics and Ancient Mediterranean Studies.

Dissertation

The candidate must complete a dissertation and pass a final oral examination (the dissertation defense) on a topic that reflects their original research and education in both the primary discipline and Classics and Ancient Mediterranean Studies in order to earn the dual-title Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title M.A. and Ph.D. in Philosophy and Women's, Gender, and Sexuality Studies

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Students must apply and be admitted to the graduate program in Philosophy and the Graduate School before they can apply for admission to the dual-title degree program. Applicants interested in the dual-title degree program may make their interest known on their applications to Philosophy. Students must apply and be admitted to the dual-title degree program in Women's, Gender, and Sexuality Studies prior to taking the qualifying exam. In addition to the admission requirements set forth by the Graduate Council and the Department of Philosophy, students will be admitted to the dual-title degree program in Women's, Gender, and Sexuality Studies by an admissions committee of Women's, Gender, and Sexuality Studies faculty, and must meet the admissions requirements of the Women's, Gender, and Sexuality Studies dual-title program. Refer to the Admission Requirements section of the Women's, Gender, and Sexuality Studies Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/womens-gender-sexuality-studies/>).

Students applying to the dual-title program must submit: a copy of the Graduate School Application originally submitted to the Philosophy Department; official transcripts from all previous course work; official GRE scores; a writing sample; a personal statement that describes how the dual-title degree program fits with their scholarly interests; and one letter of recommendation from a Women's, Gender, and Sexuality Studies faculty member at Penn State.

GPA and GRE Requirements

Applicants entering with only an undergraduate degree should have a junior/senior cumulative average of at least 3.00 (on a 4.00 scale), and, where applicable, a minimum GPA of 3.50 for all graduate work previously undertaken. Exceptions to the minimum GPA requirement may be made for students with special backgrounds, abilities, and interests at the discretion of the program.

Degree Requirements for the Dual-Title M.A.

To qualify for the dual-title degree in Philosophy and Women's, Gender, and Sexuality Studies, students must satisfy the Philosophy M.A. degree requirements listed in the Degree Requirements section. In addition to the Philosophy Department requirements, the minimum course requirements for this dual-title M.A. degree are as follows:

A total of 12 credits of course work in Women's, Gender, and Sexuality Studies. Of these 12 credits, 9 must come from the required core course sequence in Women's, Gender, and Sexuality Studies.

Code	Title	Credits
Required Courses		
WMNST 502	Global Feminisms	3
WMNST 507	Feminist Theory	3
WMNST 509	Feminist Pedagogies	3
	or WMNST 508 Feminist Methodologies	
3 credits chosen in consultation with the Women's, Gender, and Sexuality Studies Graduate Officer.		3
Total Credits		12

Credits earned at other institutions but not used to earn a degree may be applied toward the requirements for a graduate degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>).

One faculty member from Women’s, Gender, and Sexuality Studies should be included on the master’s committee. In addition, students should select a thesis topic that reflects their inquiry in Women’s, Gender, and Sexuality Studies. In the event that the master’s thesis requirement is waived by the Philosophy Department, students need to take three additional credits of Women’s, Gender, and Sexuality Studies course work and complete a master’s paper on a topic approved by the student’s committee.

Degree Requirements for the dual-Title Ph.D.

To qualify for the dual-title degree in Philosophy and Women’s Studies, students must satisfy the Philosophy Ph.D. degree requirements listed in the Degree Requirements section. In addition to the Philosophy Department requirements, the minimum course requirements for this dual-title Ph.D. degree are as follows:

18 credits of course work in Women’s, Gender, and Sexuality Studies. Of these 18 credits, 9 must come from the required core course sequence in Women’s, Gender, and Sexuality Studies.

Code	Title	Credits
Required Courses		
WMNST 502	Global Feminisms	3
WMNST 507	Feminist Theory	3
WMNST 509	Feminist Pedagogies	3
	or WMNST 508 Feminist Methodologies	
Select 9 credits: at least 6 must be at the 500 level, and all of them must be chosen in consultation with the Women’s, Gender, and Sexuality Studies Graduate Officer.		9
Total Credits		18

Credits earned at other institutions but not used to earn a degree may be applied toward the requirements for a graduate degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>).

Qualifying Examination

In accordance with Graduate Council policy, the qualifying examination committee must include at least one member of the Women’s, Gender, and Sexuality Studies Graduate Faculty. Faculty members who hold appointments in both programs’ Graduate Faculty may serve in a combined role.

Because students must first be admitted to a graduate major program of study before they may apply to and be considered for admission into a dual-title graduate degree program, dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

The dual-title field must be fully integrated into the qualifying exam for the doctoral program. In addition, the student will be required to present a portfolio of work in Women’s, Gender, and Sexuality Studies to their committee. Such a portfolio would include a statement of the student’s interdisciplinary research interests, a program plan, and samples of

writing that indicate the student’s work in Women’s, Gender, and Sexuality Studies.

Ph.D. committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Philosophy and Women’s, Gender, and Sexuality Studies dual-title doctoral degree student must include at least two members who are Women’s, Gender, and Sexuality Studies-affiliated Faculty. Faculty members who hold appointments in both programs’ Graduate Faculty may serve in a combined role. If the chair of the committee representing Philosophy is not also a member of the Graduate Faculty in Women’s, Gender, and Sexuality Studies, a member of the committee representing Women’s, Gender, and Sexuality Studies must be appointed as co-chair.

Comprehensive Exams

The Women’s, Gender, and Sexuality Studies affiliated faculty members on the student’s committee are responsible for administering a comprehensive examination in Women’s, Gender, and Sexuality Studies that constitutes a portion of the student’s comprehensive exams. The Women’s, Gender, and Sexuality Studies portion of the exam will focus on the following areas:

- feminist theory,
- feminist methodology,
- global feminism, and
- feminist studies in the student’s discipline.

Dissertation

The candidate must complete a dissertation and pass a final oral examination (the dissertation defense) on a topic that reflects their original research and education in both Philosophy and Women’s, Gender, and Sexuality Studies in order to earn the dual- title Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master’s (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master’s (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Every student admitted to the department's Ph.D. program receives full assistantship or fellowship funding (stipend and tuition waiver) for five years (assuming reasonable progress). The department awards annually an Edwin Erle Sparks Fellowship in the Humanities. In the last several years, Philosophy graduate students have received numerous external national and international fellowships and awards (such as DADD, Fulbright, Javits, Mellon). Many Philosophy graduate students have received assistantship support for interdisciplinary teaching assignments in programs such as:

- African American and Diaspora Studies,
- American Studies,
- Classics and Ancient Mediterranean Studies,
- Religious Studies, and
- Women's, Gender, and Sexuality Studies.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Philosophy (PHIL) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/phil/>)

Learning Outcomes

1. Graduates will demonstrate command of and the ability to analyze historical philosophical ideas.
2. Graduates will demonstrate the ability to elaborate new ideas in relation to contemporary issues.
3. Graduates will demonstrate the ability to use research tools such as foreign languages and logic.
4. Graduates will demonstrate the ability to clearly and effectively present their research in both oral presentations and in written formats using appropriate conventions of the discipline.
5. Graduates will demonstrate knowledge of and commitment to the professional and ethical standards of scholarly and professional work in philosophy.

Contact

Campus	University Park
Graduate Program Head	Sarah Clark Miller
Program Contact	Kaylee Elizabeth Keller 234 Sparks Building University Park PA 16802 kec5626@psu.edu (814) 865-4485 View (http://philosophy.la.psu.edu/)
Program Website	

Physics

Graduate Program Head	Mauricio Terrones
Program Code	PHYS
Campus(es)	University Park (Ph.D., M.S., M.Ed.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Master of Education (M.Ed.) View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=PHYS)
The Graduate Faculty	

Graduate instruction and research opportunities are available in:

- atomic and molecular physics,
- laser physics,
- experimental and theoretical condensed matter and materials physics,
- surface physics,
- low-temperature physics,
- statistical physics,
- acoustics,
- nuclear physics,
- experimental and theoretical particle physics,
- quantum field theory,
- general relativity,
- cosmology and relativistic astrophysics, and
- quantum gravity.

Work in some areas is conducted in cooperation with the Materials Research Institute, the Applied Research Laboratory, and other interdisciplinary research facilities.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Graduate Record Examination (GRE) scores are not required for admission. Submission is welcome if available.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/>)

gcac-300/gcac-305-admission-requirements-international-students/) for more information.

A bachelor's degree in physics or an allied field is required for admission to the M.S., and Ph.D. programs. Students with a 2.50 or higher junior/senior grade-point average (on a 4.00 scale) in physics and mathematics will be considered, and the best-qualified applicants will be accepted up to the number of spaces that are available for new students. Exceptions to the minimum 2.50 GPA may be made for students with special backgrounds, abilities, and interests. Exceptions may also be made for applicants for doctoral programs who have completed master's degrees at other institutions.

Admission and study programs for the M.Ed. degree are handled on an individual basis.

Degree Requirements

Master of Education (M.Ed.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

A minimum of 30 credits at the 400, 500, or 800 level is required, with a minimum of 18 credits at the 500 or 800 level, and at least 6 credits at the 500 level.

At least 18 credits in physics are required. Six additional nonresearch science credits (which may be in physics) and a 6-credit minor in a field of professional education also must be included. A term paper must be submitted and accepted by the department.

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A minimum of 30 credits at the 400, 500, 600, or 800 level is required. For the thesis option, at least 18 credits must be at the 500 and 600 level, combined. For the non-thesis option, at least 18 credits must be at the 500-level. 600 and 610 credits are for the thesis option only. Required courses include PHYS 559 (2 credits) and PHYS 590.

Code	Title	Credits
Required Courses		
PHYS 559	Graduate Laboratory	2
PHYS 590	Colloquium	1

There are two options.

- Thesis option: A research-based thesis must be written. The thesis must be based on at least 6 credits of PHYS 600 or PHYS 610 and must conform to Graduate School regulations. The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School.
- Nonthesis option: PHYS 530, PHYS 557, and either PHYS 561 or 410 are required. Students must complete at least 18 credits at the 500 level. This is an additional 6 to 10 credits beyond the required courses depending on whether the students take PHYS 561 or PHYS 410. A short paper must be submitted to, and accepted by, the department.

There is no degree examination for either option.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Code	Title	Credits
Required Courses		
PHYS 517	Statistical Mechanics	3
PHYS 530	Theoretical Mechanics	3
PHYS 557	Electrodynamics	3
PHYS 559	Graduate Laboratory	2
PHYS 561	Quantum Mechanics I	3
First-Year Seminar Series		
Total Credits		14

Courses required beyond these depend on the Ph.D. research subfield. Students take at least four additional 3-credit, 500-level physics courses.

A qualifying examination is given at the end of the first year, a comprehensive examination approximately two years after the qualifying examination, and a final oral examination (the dissertation defense) takes place after the completion of the dissertation. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School. There is no departmental foreign language requirement, although a reading knowledge of one foreign language may be needed in some areas of research.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

The following awards typically have been available to graduate students in this program:

Homer F. Braddock Graduate Fellowships

Available to exceptional Ph.D. candidates in several departments of the Eberly College of Science. They carry stipends of \$3,500 to \$7,500 per year for each of the first three years.

Wheeler P. Davey Memorial Fellowships

Carry stipend of variable amount and are available to a limited number of qualified graduate students in the Eberly College of Science.

David C. Duncan Graduate Fellowships

Available to first- and second-year graduate students in physics and carry a stipend of approximately \$2,000 per year for each of the first two years.

Frymoyer Scholarship

W. Donald Miller Graduate Fellowship

David H. Rank Memorial Physics Award

The Nellie and Oscar L. Roberts Fellowships

Available to graduate students majoring in the physical sciences and in biochemistry and molecular biology. Each award is for \$4,000 per year for one or two years.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Physics (PHYS) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/phys/>)

Learning Outcomes

Master of Education (M.Ed.)

1. **KNOW:** Graduates will demonstrate mastery in physics core knowledge and research methodologies that underpin the practice of modern physics. Mastery is defined as the ability to define and explain principles, recognize their application in physical phenomena, and to choose and apply appropriate principles and mathematical tools to set up and solve physics problems. Graduates will be able to apply physics concepts and combine them with high-level mathematical methods to solve problems.
2. **PROFESSIONAL PRACTICE:** Graduates will (i) know and understand professional standards of ethics and conduct, (ii) be able to analyze situations to identify the standards that should apply and (iii) will be able to describe how they may be appropriately acted upon.
3. **COMMUNICATE:** Graduates will demonstrate the ability to communicate professionally, in written form, research work and conclusions to physics sub-field expert and non-expert audiences.
4. **THINK:** Graduates will be able to summarize modern methods in physics education and curricular development for physics education.
5. **APPLY/CREATE:** Graduates will be able to apply foundational knowledge and methods to a specific research problem, they will be able to summarize the primary literature directly connected to it and

to analyze and judge new contributions to the primary literature in the same area.

Master of Science (M.S.)

1. **KNOW:** Graduates will demonstrate mastery in physics core knowledge and research methodologies that underpin the practice of modern physics. Mastery is defined as the ability to define and explain principles, recognize their application in physical phenomena, and to choose and apply appropriate principles and mathematical tools to set up and solve physics problems. Graduates will be able to apply physics concepts and combine them with high-level mathematical methods to solve problems.
2. **PROFESSIONAL PRACTICE:** Graduates will (i) know and understand professional standards of ethics and conduct, (ii) be able to analyze situations to identify the standards that should apply and (iii) will be able to describe how they may be appropriately acted upon.
3. **COMMUNICATE:** Graduates will demonstrate the ability to communicate professionally, in written form, research work and conclusions to physics sub-field expert and non-expert audiences.
4. **THINK:** Graduates will be able to summarize (i) several outstanding problems or questions in diverse subfields of physics, (ii) the experimental, observational, or theoretical origins of these problems, and (iii) the principal efforts proposed or underway to address them.
5. **APPLY/CREATE:** Graduates will be able to apply foundational knowledge and methods to a specific research problem, they will be able to summarize the primary literature directly connected to it and to analyze and judge new contributions to the primary literature in the same area.

Doctor of Philosophy (Ph.D.)

1. **KNOW:** Graduates shall demonstrate advanced knowledge and understanding in physics core knowledge (statistical mechanics, theoretical mechanics, classical electrodynamics, and quantum physics) and experimental, observational, and theoretical methodologies, that underpin the practice of modern physics.
2. **THINK:** Graduates shall demonstrate, at a level appropriate to a departmental colloquium, (i) knowledge of several outstanding problems or questions in diverse sub-fields of physics, (ii) the experimental, observational, or theoretical origins of these problems, and (iii) the principle efforts proposed or underway to address them.
3. **COMMUNICATE:** Graduates shall demonstrate the ability to communicate professionally, in written and oral form, research work and conclusions to physics sub-field expert and non-expert audiences.
4. **PROFESSIONAL PRACTICE:** Graduates shall demonstrate (i) knowledge and understanding of professional standards of ethics and conduct, (ii) the ability to analyze situations to identify the standards that should apply and (iii) describe how they may be appropriately acted upon.
5. **APPLY/CREATE:** Graduates shall have a specialty area within the broad domain of physics, within which they shall demonstrate (i) advanced knowledge and understanding of the primary literature, (ii) the ability to analyze and judge new contributions to the primary literature, (iii) the ability to pose complex research problem(s) and identify the knowledge and methodologies required to address them, and (iv) the ability to apply that knowledge and those methodologies to create new knowledge and/or develop new experimental techniques that advance (or show the potential to advance) knowledge and understanding within the specialty area.

Contact

Campus	University Park
Graduate Program Head	Mauricio Terrones
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Irina Mocioiu
Program Contact	Brian Moore 107 Davey Lab University Park PA 16802 brm186@psu.edu (814) 863-0118
Program Website	View (https://bulletins.psu.edu/graduate/programs/majors/physics/)

Piano Performance

Graduate Program Head	Ann Marie Stanley
Program Code	PIANO
Campus(es)	University Park (D.M.A.)
Degrees Conferred	Doctor of Musical Arts (D.M.A.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=PIANO)

The School of Music is an accredited institutional member of the National Association of Schools of Music.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The School of Music requires the completion of a recognized baccalaureate degree in music or music education, with a junior/senior grade-point average of 3.00 or higher (on a 4.00 scale).

Admission to the D.M.A. (major in piano performance) requires an audition in person or by video recording of an extensive memorized program; students admitted to this program must perform musically at least at the level required to complete the degree Master of Music at Penn State, and must show potential ability to perform professionally.

Additional requirements include an interview in person or by interactive video to assess language skills.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Doctor of Musical Arts (D.M.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The Doctor of Musical Arts is offered with a major in Piano Performance. Four semesters in residence are required. The degree is designed to provide students with a thorough background of preparation and experience in professional-level performance and in the literature of the instrument, while becoming sufficiently knowledgeable about the discipline of music as a whole, in order to teach at the collegiate or university level. This background knowledge would include, but not be limited to, music theory, analysis, and history. The School of Music sponsors many musical ensembles, and candidates for performance degrees are required to participate in positions of responsibility.

Sixty credits are required beyond the Master of Music; if an exceptional student is admitted before completion of a prior Master of Music degree, the student will complete a total of 30 credits in categories equivalent to those required for the M.Mus., in addition to the 60 required for the D.M.A. Minimum course requirements (post-Master's degree) include 16 credits (four semesters at 4 credits/semester) of KEYBD 580; 4 credits of advanced ensembles; 10 credits of literature and pedagogy in the major area; and 18 credits in the broader discipline of music.

A qualifying examination will follow upon two semesters completed in residence. The comprehensive examination will occur upon the completion of course work, before the final recital. The culminating experience of the D.M.A. degree is public performance: three memorized solo recitals are required (the final recital is prepared independently), and two recitals of chamber music. Although no written dissertation is required, a lecture-recital is required, with a pre-approved monograph text.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Music-Keyboard (KEYBD) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/keybd/>)

Learning Outcomes

1. **KNOW:** Demonstrate thorough knowledge of the major stylistic trends of the Western classical music canon, the major composers, and their representative works for piano. Know the common-use elementary and intermediate repertoire for the instrument by methodology, composer, and publisher.
2. **APPLY/CREATE:** Research composers, compositions, recordings, and methodologies using scholarly sources and techniques. Teach students from beginner levels to advanced collegiate students, in classroom or studio settings. Prepare solo and chamber recital programs up to professional standards.
3. **COMMUNICATE:** Communicate verbally and with applied demonstration at the instrument using analysis and advanced coaching techniques to teach the variety of requisite collegiate degrees. Present research at professional conferences.
4. **THINK:** Articulate in writing aesthetic and semiotic principles related to musical communication and understanding as expected for a university professor.
5. **PROFESSIONAL PRACTICE:** Conduct applied lessons and classroom teaching respectfully and appropriately with regard to student physical boundaries. Maintain academic integrity in both written research and oral presentations. Interact with colleagues in ensembles settings in a respectful, professional, and effective manner.

Contact

Campus	University Park
Graduate Program Head	Ann Marie Stanley
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Rachel E Copeland
Program Contact	Lacy Miller School of Music 233 Music Building I University Park PA 16802 ljs216@psu.edu (814) 865-5568
Program Website	View (https://arts.psu.edu/academics/school-of-music/)

Plant Biology

Graduate Program Head	Teh-Hui Kao
Program Code	PLBIO
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=PLBIO)

The Intercollege Graduate Degree Program in Plant Biology includes faculty from ten departments in the College of Agricultural Sciences, College of Engineering, and Eberly College of Science. Each student becomes associated with the adviser's department, which may provide financial support, research facilities, and office space. Applicants are encouraged to explore opportunities by contacting faculty who may be prospective advisers.

The objective of this program is to educate and train plant biologists using the most modern techniques available today. Graduates from this program have gone on to a diverse range of careers, including positions in colleges and universities, research institutes, industry, and government. Research interests of the program faculty span the breadth of scientific areas ranging from molecular, cell, and evolutionary biology, biochemistry, biophysics, genetics, and functional genomics to whole-plant physiology and ecology. Student training includes a comprehensive set of team-taught courses that reflects this breadth of scientific approaches.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students with a 3.00 junior/senior grade-point average (on a 4.00 scale) and with appropriate course background will be considered for admission. The best-qualified applicants will be accepted up to the number of spaces available for new students. Students entering this program should have a strong foundation in the biological sciences, including biochemistry, general physics, and college mathematics through calculus. Students with limited deficiencies may be admitted but must make up their deficiencies concurrently with their graduate studies. B.S.-level applicants with good academic records who have had strong training in plant biology and related courses, including research experience, are generally admitted directly into the Ph.D. program. GRE scores are not required for admission.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

All M.S. degree candidates will be required to complete 31 credits of course work at the 400, 500, 600, or 800 level, with at least 18 credits at the 500 and 600 level, combined. All students must complete the core courses:

Code	Title	Credits
Required Courses		
PLBIO 512	Plant Resource Acquisition and Utilization	4
PLBIO 513	Integrative Plant Communication and Growth	4
MCIBS 591	Ethics, Rigor, Reproducibility and Conduct of Research in the Life Sciences	2
PLBIO 590	Colloquium	1
Electives		
Elective credits may be chosen from a list of approved electives maintained by the program office.		14
Culminating Experience		
PLBIO 600	Thesis Research	6
or PLBIO 610	Thesis Research Off Campus	
Total Credits		31

Students are required to write a thesis, and at least 6 credits in thesis research (PLBIO 600 or PLBIO 610) must be taken in conjunction with completing the thesis. The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School, and the student must pass a thesis defense.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Students in the Ph.D. program must successfully pass the qualifying, comprehensive, and final oral examinations required by Graduate Council. To earn the Ph.D. degree, doctoral students must also write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Ph.D. candidates must complete a minimum of 18 credits, including the following courses:

Code	Title	Credits
Required Courses		
PLBIO 512	Plant Resource Acquisition and Utilization	4
PLBIO 513	Integrative Plant Communication and Growth	4
PLBIO 514	Modern Techniques and Concepts in Plant Ecophysiology	2
PLBIO 515	Modern Techniques and Concepts in Plant Cell Biology	2
PLBIO 516	Modern Techniques and Concepts in Plant Molecular Biology	2
MCIBS 591	Ethics, Rigor, Reproducibility and Conduct of Research in the Life Sciences	2
PLBIO 590	Colloquium	2
Two biochemistry courses ¹		
Total Credits		18

¹ A list of courses approved to count towards the biochemistry course requirement is maintained by the graduate program office.

Upon consultation with the head of the graduate program, equivalent courses taken at another university may be substituted for some of the above requirements. Based on the results of the qualifying examinations,

the student's adviser and Ph.D. committee will determine other course requirements.

One of the main goals of the qualifying examination is to determine the potential of a student to successfully obtain a Ph.D. degree, and it is intended to be a rigorous test of a student's abilities prior to the major investment in time and effort necessary to pass the comprehensive examination. Students enrolled in the Ph.D. program must pass a written English competency evaluation based on the dossier of papers written for PLBIO 512 and PLBIO 513. This evaluation is done at the end of the student's first year. The oral qualifying examination is based on two of the papers, jointly chosen by the student and the Qualifying Examination Committee, and must be passed by the end of the student's third semester.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

In most participating departments, Plant Biology applicants are eligible for departmental teaching or research assistantships, and other assistantships supported by grant funds of individual faculty who make the award decisions. More detailed and up-to-date information about student aid may be found in the Plant Biology Student and Faculty Handbook (<https://www.huck.psu.edu/content/graduate-programs/plant-biology/requirements/>), which is updated annually during the summer.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up

deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Plant Biology (PLBIO) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/plbio/>)

Learning Outcomes

Master of Science (M.S.)

1. **Know:** Students will demonstrate broad knowledge of essential background and recent developments in diverse areas of plant biology, and familiarity with modern techniques and methodologies used in the chosen area of research.
2. **Apply/Create:** Students will demonstrate ability to conduct research in the chosen area of plant biology, including formulating hypotheses based on previous work in the field, designing experimental approaches, carrying the project to completion, and assembling the findings into a written work that advances understanding in the field.
3. **Communicate:** Students will demonstrate ability to disseminate the findings of their research in well-organized writing, as well as in formal research seminars/talks.
4. **Think:** Students will demonstrate ability to critically analyze published work by others in their specialty area.
5. **Professional Practice:** Students will demonstrate knowledge and comprehension of research ethics issues, including ethical principles related to authorship, research reporting, data fabrication, plagiarism, conflicts of interest, peer review, and data sharing.

Doctor of Philosophy (Ph.D)

1. **Know:** Students will demonstrate in-depth knowledge of essential background and key developments in diverse areas of plant biology, and demonstrate knowledge of modern techniques/methodologies used in plant biology research.
2. **Apply/Create:** Students will demonstrate ability to design and carry out a major research project in the chosen area of plant biology, including formulating hypotheses based on previous work in the field, and assembling new findings into a written work that advances understanding in the field.
3. **Think:** Students will demonstrate ability to critically analyze work by others in their specialty area.
4. **Communicate:** Students will demonstrate ability to convey scientific ideas and results in clear, concise, and well-organized writing, as well as in formal oral or poster presentations at professional conferences/meetings.
5. **Professional Practice:** Students will demonstrate knowledge and comprehension of research ethics issues, including ethical principles related to authorship, research reporting, data fabrication, plagiarism, conflicts of interest, peer review, data sharing.
6. **Teach:** Students will demonstrate effective skills in undergraduate teaching using effective pedagogical practice.

Contact

Campus	University Park
Graduate Program Head	Teh-Hui Kao
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Teh-Hui Kao
Program Contact	Freya Heryla 101 Life Sciences Building University Park PA 16802 fqh5144@psu.edu (814) 863-3273
Program Website	View (https://www.huck.psu.edu/graduate-programs/plant-biology/)

Plant Pathology

Graduate Program Head	Maria Del Mar Jimenez Gasco
Program Code	PPATH
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Dual-title Ph.D. in Plant Pathology and Biogeochemistry Dual-title Ph.D. and M.S. in Plant Pathology and International Agriculture and Development Dual-title Ph.D. in Plant Pathology and Microbiome Sciences
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=PPATH)

Plant pathology is the study of disease in plants and concerns the dynamic interaction between the plant, the causal agent (bacteria, fungi, viruses, nematodes, etc.), and their environments. A student prepares for a professional career in research, teaching, extension, or industry through advanced studies of the principles of plant infection, the physiology of disease in plants, the ecology of root diseases, the nature and inheritance of disease resistance in plants, epidemiology, microbial ecology, phytobiomes, translational taxonomy, ecology and physiology of air pollution injury to plants, or plant disease management by biological or chemical means. A student may specialize in the etiology and integrated management of diseases of forest trees, agronomic or horticultural crops. Advanced studies in molecular systematics of fungi and applied mycology, related to the production of the commercial mushroom, are also available. Modern, well-equipped laboratories, controlled environment facilities and greenhouses, and well-developed field research areas are available for graduate study.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The best-qualified applicants will be accepted up to the number of spaces and advisers that are available for new students. Students with a 3.00 junior/senior average (on a 4.00 scale) and with appropriate course backgrounds will be considered for admission. Exceptions to

the minimum 3.00 grade-point average may be made at the program's discretion for students with special backgrounds, abilities, and interests. GRE scores are not required for admission.

Students are expected to have a strong foundation in biological and physical sciences. Generally, students with B.S. degrees in biology, microbiology, plant science, molecular biology, or biochemistry are well prepared for graduate study in Plant Pathology.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The Master of Science degree program in Plant Pathology leads students either to the development of special proficiencies in Plant Pathology, which will allow the individual to directly enter a professional career, or to the development of a basic knowledge of the discipline, allowing for advancement to the Ph.D. degree. M.S. degree students will be introduced to the broad aspects of the field of plant pathology, including:

- exposure to the various causal agents of plant disease and the diseases they incite;
- diseases of current and classical importance affecting a wide range of crop plants;
- a variety of techniques used to isolate, characterize, and identify causal agents of plant disease; and
- an appreciation for the relationship between plant pathology and other biological and physical sciences.

A minimum of 30 credits at the 400, 500, 600, or 800 level is required, with at least 18 credits in the 500 and 600 series combined.

Code	Title	Credits
Required Courses		
PPEM 405	Microbe-Plant Interactions: Plant Disease and Biological Control	3
PPATH 502	Plant Disease Diagnosis	3
PPATH 505	Fundamentals of Phytopathology	4
PPATH 522	Professional Development & Ethics in Plant Pathology	1
PPATH 590	Colloquium ¹	2
ADDITIONAL COURSES		
All M.S. students must take a minimum of 9 total credits from the following two lists, as described.		
<i>Microbial Groups (choose at least 6 credits):</i>		6
PPEM 416	Plant Virology: Molecules to Populations	
PPEM 417W	Mechanisms of Bacterial Pathogenesis in Plants	
PPEM 425	Biology of Fungi	
<i>Microbial Interactions and the Environment (choose at least 3 credits):</i>		3
PPEM 412	Turfgrass Disease Management or PPEM 412	
PPEM 440	Introduction to Microbiome Analysis	
PPEM 454	Virus Ecology	
PPEM 456	Applied Microbial Ecology	
AGECO 457	Principles of Integrated Pest Management	
PPATH 533	Molecular Genetics of Plant-Pathogen Interactions	

PPATH 542	Epidemiology of Plant Diseases	
AGBIO 802	Plant Protection: Responding to Introductions of Threatening Pests and Pathogens	
Electives		
As approved by the thesis adviser, M.S. students must choose an additional two credits of 400, 500, 600 or 800 level courses in PPEM, PPATH or a related field.		2
Culminating Experience ²		
PPATH 600	Thesis Research	6
	or PPATH 610 Thesis Research Off Campus	
Total Credits		30

¹ All students are required to register for and participate in PPATH 590 (1 credit Pass/Fail) for all semesters enrolled. No more than two (2) credits of PPATH 590 may count towards the Master's degree.

² A maximum of 6 thesis credits can be applied to the 18 credits required at the 500-600 level.

Students may complete additional course work at other levels as required and/or approved by their committee.

Equivalent courses taken in a previous program may be substituted for M.S. course requirements, by approval of the Program. However, equivalent courses cannot be applied to the 30-credit requirement.

Master's degree students must prepare and present seminars in the departmental PPATH 590, which will evaluate English communication skills. During their studies, Master's degree students may have an opportunity to assist in teaching a disciplinary subject.

All Master's degree students must write a thesis proposal which must be accepted by the adviser(s), committee members, and the Head of the Graduate Program. All Master's degree students must write a thesis which must be accepted by the adviser(s), committee members, the Head of the Graduate Program, and the Graduate School. The student must present and pass a final oral thesis defense.

Doctor of Philosophy (ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Code	Title	Credits
Required Courses		
PPEM 405	Microbe-Plant Interactions: Plant Disease and Biological Control	3
PPATH 502	Plant Disease Diagnosis	3
PPATH 505	Fundamentals of Phytopathology	4
PPATH 522	Professional Development & Ethics in Plant Pathology	1
PPATH 590	Colloquium ¹	2
PPATH 602	Supervised Experience in College Teaching ²	1
ADDITIONAL COURSES		
All Ph.D. students must take a minimum of 6 total credits from the following two lists, taking a minimum of 3 each as described.		
<i>Microbial Groups (choose at least 3 credits):</i>		3
PPEM 416	Plant Virology: Molecules to Populations	
PPEM 417W	Mechanisms of Bacterial Pathogenesis in Plants	

PPEM 425	Biology of Fungi	
<i>Microbial Interactions and the Environment (choose at least 3 credits):</i>		3
PPEM 412	Turfgrass Disease Management or PPEM 412WC	
PPEM 440	Introduction to Microbiome Analysis	
PPEM 454	Virus Ecology	
PPEM 456	Applied Microbial Ecology	
AGECO 457	Principles of Integrated Pest Management	
PPATH 533	Molecular Genetics of Plant-Pathogen Interactions	
PPATH 542	Epidemiology of Plant Diseases	
AGBIO 802	Plant Protection: Responding to Introductions of Threatening Pests and Pathogens	
Culminating Experience		
PPATH 600	Thesis Research	6
or PPATH 610	Thesis Research Off Campus	
Total Credits		26

¹ Ph.D. students enrolled in the PPATH graduate program must enroll in PPATH 590 every semester until they have passed their comprehensive exam. Two credits of PPATH 590 can be counted toward the degree requirements.

² Students may take up to 3 credits of PPATH 602 Supervised Experience in College Teaching.

Students may enroll in other courses tailored to the individual by the student's Ph.D. committee.

Ph.D. students must prepare and present seminars in the departmental PPATH 590, which will evaluate English communication skills. During their studies, Ph.D. students will have an opportunity to assist in teaching a disciplinary subject.

All doctoral students must pass a qualifying examination, a comprehensive examination, and a final oral examination (the dissertation defense). To earn the Ph.D. degree, doctoral students must also write a dissertation proposal and a dissertation. The dissertation proposal must be accepted by the adviser(s), committee members, and the head of the graduate program. The dissertation must be accepted by the adviser(s), committee members, and the head of the graduate program, and the Graduate School. The student must present and pass a dissertation defense.

Dual-Titles

Dual-Title Ph.D. in Plant Pathology and Biogeochemistry

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Doctoral students with research and educational experiences in plant pathology and environmental microbiology may apply to the Plant Pathology/Biogeochemistry Dual-Title Doctoral Degree Program. The goal of the dual-title Ph.D. degree in Plant Pathology and Biogeochemistry is to enable PPATH graduate students to acquire the knowledge and skills of their major area of specialization in PPATH, while at the same time gaining expertise and skills in biogeochemistry. Graduate study in this program seeks to provide students with the intellectual foundation for integrated and mechanistic understanding of interactions between plant

hosts, microbes, and environmental systems. Interdisciplinary training that includes biogeochemistry will prepare students for positions in academia, government, non-profit organizations, and the private sector. It will also prepare students for a wide array of research careers in the private sector, including agricultural and environmental sciences, energy industries, and the integrated study of the sustainability of biological systems.

Admission Requirements

For admission to the dual-title doctoral degree in Biogeochemistry, a student must first apply and be admitted to the Plant Pathology graduate program and The Graduate School, preferably but not necessarily discussing the dual-title interest beforehand with a major adviser who has been appointed to the Biogeochemistry program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Biogeochemistry dual-title program. Refer to the Admission Requirements section of the Biogeochemistry Bulletin page (p. 137). Doctoral students must be admitted into the dual-title degree program in Biogeochemistry prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the Plant Pathology Ph.D. degree requirements. In addition, students pursuing the dual-title Ph.D. in Plant Pathology and Biogeochemistry must complete the degree requirements for the dual-title Biogeochemistry Ph.D., listed on the Biogeochemistry Bulletin page (p. 137). Students are required to have two advisers from separate disciplines: one individual serving as a primary adviser in their major degree program and a secondary adviser in an area within a field covered by the dual-title program who is a member of the Biogeochemistry Graduate Faculty. The major program adviser normally will also be a member of the Biogeochemistry Graduate Faculty. The two faculty advisers can represent different academic programs, but this is not required, as faculty from a scientifically diverse department could represent very different areas of expertise.

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Plant Pathology and must include at least one Graduate Faculty member from the Biogeochemistry program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Plant Pathology and Biogeochemistry. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Plant Pathology and Biogeochemistry dual-title doctoral degree student must include at least one member of the Biogeochemistry Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Biogeochemistry, the member of the committee representing Biogeochemistry must be appointed as co-chair. The Biogeochemistry representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students enrolled in the dual-title program are required to write and orally defend a dissertation on a topic that reflects their original research and education in Plant Pathology and Biogeochemistry. Upon completion

of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title M.S. and Ph.D. in Plant Pathology and International Agriculture and Development

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Graduate students with research and educational interests in international education may apply to the Plant Pathology/INTAD Dual-Title Degree Program. The goal of the dual-title degree in Plant Pathology and INTAD is to enable graduate students to acquire the knowledge and skills of their primary area of specialization in Plant Pathology, while at the same time gain the perspective and methods needed for work in international agriculture. Graduate study in this program seeks to prepare students to assume leadership roles in science, science education, outreach, and project management anywhere in the world. Students are required to write research proposals and grants to support their research activities, reflecting the dual-title degree. As part of their professional development presentations, publication of research articles and active participation in professional societies is expected. Emphasis is placed upon the professional development of the student. Students are able to specialize in the research program areas of:

- plant-microbe interactions,
- plant disease biology and epidemiology,
- environmental microbiology,
- mycology,
- plant virology,
- mushroom biology,
- genomics, and
- disease management.

They will acquire a broad perspective on applying their research findings in the context of the broader international community. The dual-title will allow students to master their field of specialization from an international perspective allowing them to compare practices and outcomes between countries and regions.

Admission Requirements

Students must apply and be admitted to the graduate program in Plant Pathology and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the INTAD dual-title program. Refer to the Admission Requirements section of the INTAD Bulletin page (p. 477). Doctoral students must be admitted into the dual-title degree program in INTAD prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Plant Pathology. In addition, students pursuing the dual-title in Plant Pathology and INTAD must complete the degree requirements for the dual-title in INTAD, listed on the INTAD Bulletin page (p. 477).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Plant Pathology and must include at least one Graduate Faculty member from the INTAD program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Plant Pathology and INTAD. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Plant Pathology and INTAD dual-title doctoral degree student must include at least one member of the INTAD Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in INTAD, the member of the committee representing INTAD must be appointed as co-chair. The INTAD representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students enrolled in the dual-title program are required to write and orally defend a dissertation on a topic that reflects their original research and education in Plant Pathology and INTAD. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title Ph.D. in Plant Pathology and Microbiome Sciences

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Doctoral students with research and educational experiences in plant pathology and environmental microbiology may apply to the Plant Pathology-Microbiome Sciences Dual-Title Doctoral Degree Program. The goal of the dual-title Ph.D. degree in Plant Pathology and Microbiome Sciences is to enable PPATH graduate students to acquire the knowledge and skills of their major area of specialization in PPATH, while at the same time gaining expertise and skills in Microbiome Sciences. Graduate study in this program seeks to provide students with the intellectual foundation for integrated and mechanistic understanding of interactions between plant hosts, microbes, and environmental systems. Interdisciplinary training that includes Microbiome Sciences will prepare students for positions in academia, government, non-profit organizations, and the private sector, including agricultural and environmental sciences, energy industries, and the integrated study of the sustainability of biological systems.

Admission Requirements

For admission to the dual-title doctoral degree in Microbiome Sciences, a student must first apply and be admitted to the Plant Pathology PhD graduate program and The Graduate School, preferably but not necessarily discussing the dual-title interest beforehand with a major adviser who has been appointed to the Microbiome Sciences program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Microbiome Sciences dual-title program. Refer to the Admission

Requirements section of the Microbiome Sciences Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/microbiome-sciences/>). Doctoral students should enroll in a dual-title graduate degree program early in their training, and no later than the end of the fourth semester (not counting summer semesters) of entry into the graduate major program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the Plant Pathology Ph.D. degree requirements. In addition, students pursuing the dual-title Ph.D. in Plant Pathology and Microbiome Sciences must complete the degree requirements for the dual-title Microbiome Sciences Ph.D., listed on the Microbiome Sciences Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/microbiome-sciences/>). Students are required to have two advisers from separate disciplines: one individual serving as a primary adviser in their major degree program and a secondary adviser in an area within a field covered by the dual-title program who is a member of the Microbiome Sciences Graduate Faculty. The major program adviser normally will also be a member of the Microbiome Sciences Graduate Faculty. The two faculty advisers can represent different academic programs, but this is not required, as faculty from a scientifically diverse department could represent very different areas of expertise.

The qualifying examination for Plant Pathology will satisfy the qualifying examination requirement for the dual-title degree program in Microbiome Sciences.

In addition to the general Graduate Council requirements for Ph.D. committees (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>), the Ph.D. committee of a Plant Pathology and Microbiome Sciences dual-title doctoral degree student must include at least one member of the Microbiome Sciences Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Microbiome Sciences, the member of the committee representing Microbiome Sciences must be appointed as co-chair. The Microbiome Sciences representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students enrolled in the dual-title program are required to write and orally defend a dissertation on a topic that reflect their original research and education in Plant Pathology and Microbiome Sciences. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)

- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Plant Pathology (PPATH) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/ppath/>)

Learning Outcomes

Master of Science (M.S.)

1. Graduates will demonstrate breadth and depth in their knowledge of the principles, concepts and methods of the field of Plant Pathology and its related disciplines, and be able to critically evaluate, integrate, and apply that knowledge.
2. Graduates will execute a scientific plan that furthers knowledge in plant pathology and its related disciplines.
3. Graduates will effectively communicate in oral and written format research findings to professional peers, and be capable of translating knowledge to stakeholders and the public.
4. Students will engage in professional activities that promote values for diversity, mentorship and public and professional service, in accordance with the American Phytopathological Society's Code of Professional Conduct.

doctor of Philosophy (Ph.d.)

1. Graduates will demonstrate breadth and depth in their knowledge of the principles, concepts and methods of the field of Plant Pathology and its related disciplines, and be able to critically evaluate, integrate and apply that knowledge.
2. Graduates will be capable of independently formulating and executing a scientific plan that significantly furthers knowledge in Plant Pathology and its related disciplines.
3. Graduates will effectively communicate in oral and written format research findings to professional peers, and effectively translate knowledge to stakeholders and the public.

4. Graduates will have a strong working knowledge of the past, current and future impacts of Plant Pathology and its related disciplines on human affairs, and use this knowledge to guide their research and pedagogical activities.
5. Students will conduct professional activities in ways that promote values for diversity, mentorship and public and professional service, in accordance with the American Phytopathological Society's Code of Professional Conduct.

Contact

Campus	University Park
Graduate Program Head	Maria Del Mar Jimenez Gasco
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	John Andrew Pecchia
Program Contact	Kim Hall 210 Buckhout Lab University Park PA 16802 kah6753@psu.edu View (http://plantpath.psu.edu/)
Program Website	

Political Science

Graduate Program Head	Lee Ann Banaszak
Program Code	PLSC
Campus(es)	University Park (Ph.D., M.A.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Arts (M.A.) Dual-Title Ph.D. in Political Science and African American and Diaspora Studies Dual-Title Ph.D. in Political Science and African Studies Dual-Title Ph.D. in Political Science and Asian Studies Dual-Title Ph.D. in Political Science and Social Data Analytics Dual-Title Ph.D. and M.A. in Political Science and Women's, Gender, and Sexuality Studies
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=PLSC)

The purpose of the graduate program in Political Science is to train professional political scientists who intend to pursue careers in research, teaching, and public service. The department offers programs leading to the M.A. and Ph.D. degrees. The programs are designed to enable students to acquire both methodological sophistication and substantive knowledge in a variety of fields.

The graduate program in Political Science encourages the study of a variety of substantive concerns, methodological approaches, and research skills. Among the department's special areas of strength are United States politics (public opinion and voting, state politics and policy, race, ethnicity and politics, and judicial politics); international relations (international and domestic political conflict, terrorism, and international political economy); comparative politics (authoritarian politics, comparative political behavior, political parties, and social

movements); and political methodology (social data analytics, network analysis, time series analysis, and text as data).

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Entrance to the Political Science graduate program occurs in the fall semester. Applications must be received by the department no later than December 10 for fall admission. However, the department will begin accepting applications as of October 1.

The Department of Political Science requires M.A. and Ph.D. program applicants to submit

- official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>),
- a statement of career plans and proposed emphasis in political science,
- at least three letters of recommendation from persons familiar with the applicant's academic performance, and
- a writing sample demonstrating research and/or analytical skills.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Students can be admitted to the master's degree program or, after passing a Ph.D. qualifying exam, can be admitted to the Ph.D. program with a master's degree.

Degree Requirements

Master of Arts (M.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Depending on the student's previous methodological training, 30 credits of course work, including an essay, are required for a master's degree. At least 18 credits must be at the 500 level. The course work includes:

Code	Title	Credits
Required Courses		
PLSC 501	Methods of Political Analysis	3
PLSC 502	Statistical Methods for Political Research	3
PLSC 503	Multivariate Analysis for Political Research	3
18 additional credits in Political Science		18
3 credits for the M.A. essay		3
Total Credits		30

Students also take a seminar on teaching and professional development in political science. There are no language requirements for the degree.

Every master's student is required to pass an examination of their master's essay.

Credits earned at other institutions but not used to earn a degree may be applied toward the requirements for a graduate degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>).

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The Department of Political Science requires a minimum total of 60 post-baccalaureate credits for the Ph.D. At least 45 credits, exclusive of the dissertation, must be in political science. Course work accepted for the M.A. in Political Science at Penn State will count toward the department's 60-credit requirement. In the case of students who have earned credits in an advanced degree program at another university or in another department at Penn State, a maximum of 30 credits may count toward the 60-credit departmental requirement.

In the case of transfer students, a maximum of 30 credits earned in an advanced degree program at another university or in another department at Penn State will count toward the 60-credit requirement.

The department requires that a student complete the designated "core" courses in methodology (PLSC 501, PLSC 502, and PLSC 503) and two 1.5-credit seminars on teaching, writing, and professional development in Political Science. Students must complete an additional 24 credit hours in political science, chosen in consultation with their advisor. Students must also complete an additional 9 hours of coursework, chosen in consultation with their advisor, which may be taken in political science or another discipline.

The communication and foreign language requirement for the Ph.D. may be satisfied by advanced course work and competence developed in foreign languages, statistics, or other research methods.

To earn the Ph.D. degree, doctoral students must successfully pass a qualifying examination, comprehensive examination, and final oral examination (the dissertation defense). Ph.D. candidates must also write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Titles

Dual-Title Ph.D. in Political Science and African American and diaspora Studies

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Graduate students with research and teaching interests in African American and Diaspora Studies and politics may apply to the dual-title master's or doctoral degree program in Political Science and African American and Diaspora Studies. The goal of the dual-title graduate degree program in Political Science and African American and Diaspora Studies is to enable graduate students from Political Science to acquire the knowledge and skills of their major area of specialization in Political

Science while at the same time studying the discipline of African American and Diaspora Studies.

In order to prepare graduate students for the competitive job market, this program provides them with a solid foundation in both disciplines as well as interdisciplinary training that will allow them to compete for the best jobs in both Political Science and African American and Diaspora Studies. For such students the dual-title graduate degree in African American and Diaspora Studies will add value to their degree and their status as candidates. It will produce excellent political scientists who are experts in African American and Diaspora Studies as well. The dual-title graduate degree in Political Science and African American and Diaspora Studies will build curricular bridges beyond the student's major field so as to provide unique training for the interdisciplinary scholar.

Admission Requirements

The Department of Political Science and African American and Diaspora Studies offer a dual degree in Political Science and African American and Diaspora Studies. Dual-title PLSC and AFAMD graduate students will first be admitted to PLSC in accordance with the requirements stipulated by the Graduate Council and the department. After admission to the PLSC Ph.D. program, students must apply for admission to and meet the admissions requirements of the African American and Diaspora Studies dual-title program. Refer to the Admission Requirements section of the African American and Diaspora Studies Bulletin page. Doctoral students must be admitted into the dual-title degree program in African American and Diaspora Studies prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

The Ph. D. in Political Science and African American and Diaspora Studies is awarded to students who are admitted to the Political Science doctoral program and admitted subsequently into the dual-title degree in African American and Diaspora Studies. The minimum course requirements for the dual-title Ph.D. degree in Political Science and African Studies are as follows:

- A minimum of 60 post-baccalaureate credits. Course work accepted for the M.A. in Political Science will count toward the 60-credit requirement. Forty-five credits, exclusive of dissertation research credits, must be in Political Science. At least 15 credits must be fulfilled by the requirements of African American and Diaspora Studies.
- 15 credits of African American-related coursework, of which the following are required: AFAM 501, AFAM 502, and AFAM 503. At least three additional credits will be in substantive courses beyond Political Science (e.g. courses that are not cross-listed between PLSC and AFAM).
- Of these requirements, at least 51 credits must be at the 500 level. Additionally, there is a 6-credit maximum for independent study.
- Students are expected to conduct research for the Ph.D. dissertation on racial and ethnic politics with an emphasis on African descendant populations.
- Completion of the designated core of courses in methodology (PLSC 501, PLSC 502, and PLSC 503).
- Completion of two 1.5-credit seminars on teaching, writing, and professional development in Political Science.
- Completion of 15 credits of additional coursework (beyond the methodology and professionalization courses) in political science.
- Completion of 9 credits of elective coursework

Qualifying Exam

Students must meet the Ph.D. qualifying examination requirements specified by the PLSC program. During the qualifying examination, the student will also be assessed for qualifying to the dual-title program.

The qualifying examination committee for the dual-title degree will be composed of the student's faculty advisor, a graduate faculty member from Political Science, and at least one graduate faculty member from African American and Diaspora Studies. One of these members should be a faculty member from whom the student has taken at least one course.

There will be a single qualifying examination, containing elements of both PLSC and AFAMD. The student will have to pass in both areas, PLSC and AFAMD in order to qualify for a dual-title. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

Ph.D. committee Composition

The Ph.D. committee of a dual-title doctoral degree student must include a minimum of four Graduate Faculty members—the chair and at least three additional members. The committee must include at least one member of the African American and Diaspora Studies graduate faculty. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in AFAMD, the member of the committee representing AFAMD must be appointed as co-chair. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role.

Comprehensive Exam

After completing all course work, doctoral students in the dual-title doctoral degree program in Political Science and African American and Diaspora Studies must pass a comprehensive examination that includes written and oral components. The written portion of the comprehensive examination must include a substantial African American and Diaspora Studies component, and one of the evaluators for the project must be affiliated with African American and Diaspora Studies. The oral component of the comprehensive examination involves the defense of a dissertation prospectus, which must contain substantial African American and Diaspora Studies content. If a student does not pass the African American and Diaspora Studies component of the exam, the student will no longer continue in the dual-title program Ph.D. program, although Political Science may elect to allow the student to continue in the Ph.D. program in Political Science.

Dissertation and Dissertation Defense

The doctoral dissertation must engage questions related to racial and ethnic politics with an emphasis on African descendant populations; that is, students in this program are required to write and orally defend a dissertation on a topic that reflects their original research in an interdisciplinary spirit. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title Ph.D. in Political Science and African Studies

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Political Science doctoral students who have research and educational interests in comparative policy analyses, environmental change and livelihood systems, socio-economic and political change, and other aspects of African Studies may apply to the dual-title doctoral degree

program in Political Science and African Studies. The goal of the program is to enable graduate students from Political Science to complement their knowledge and skills in a major area of specialization in Political Science with in-depth knowledge of prevailing theories on and problem-solving approaches to thematic, regional, or national issues pertaining to African development and change.

The dual-title doctoral degree program provides interested Political Science doctoral students with a multidisciplinary approach that enhances their analytical capabilities for addressing key issues in African development and adds value to their Political Science degree by increasing their competitiveness in the job market. The well-rounded, regional specialist who graduates from this program, is likely to be employed in an international setting. The program, therefore, enhances the reputation of the Political Science department, the College of the Liberal Arts, and Penn State.

Admission Requirements

Students must apply and be admitted to the graduate program in Political Science and the Graduate School before they can apply for admission to the dual-title degree program. Applicants interested in the dual-title degree program may make their interest in the program known clearly on their applications to Political Science and include remarks in their statement of purpose that address the ways in which their research and professional goals in political science reflect an interest in African Studies-related research. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the African Studies dual-title program. Refer to the Admission Requirements section of the African Studies Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/african-studies/>). Doctoral students must be admitted into the dual-title degree program in African Studies prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Political Science. In addition, students must complete the degree requirements for the dual-title in African Studies, listed on the African Studies Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/african-studies/>). Final course selection is determined by the student in consultation with the Political Science and African Studies academic advisers. Upon acceptance by the African Studies admissions committee, the student will be assigned an African Studies academic adviser in consultation with the African Studies director and the African Studies admissions committee. As a student develops specific scholarly interests, s/he may request a different African Studies adviser from the one assigned by the African Studies admissions committee. The student and Political Science and African Studies academic advisers are to establish a program of study that is appropriate for the student's professional objectives and that is in accordance with the policies of the Graduate Council, the Political Science graduate program and the African Studies Program.

The Ph.D. in Political Science and African Studies is awarded to students who are admitted to the Political Science doctoral program and admitted subsequently into the dual-title degree in African Studies. The minimum course requirements for the dual-title Ph.D. degree in Political Science and African Studies are as follows.

- A minimum of 60 post-baccalaureate credits. Course work accepted for the M.A. in Political Science will count toward the 60-credit requirement. At least 45 credits, exclusive of dissertation research credits, must be in Political Science.

- Completion of the designated core of courses in methodology (PLSC 501, PLSC 502, and PLSC 503).
- Completion of two 1.5-credit seminars on teaching, writing, and professional development in Political Science.
- Completion of 15 hours of additional coursework (beyond the methodology and professionalization courses) in political science.
- Completion of 9 credits of elective coursework
- AFR 501 (3)
- 15 credits of Africa-related course work at the 400 or 500-level; minimum of 3 of these credits must be taken from a list of courses maintained by the African Studies program chair.
- As many as 6 of the 15 credits may come from Political Science, as approved by the student's Political Science and African Studies Program academic advisers.
- The remaining credits can be taken in AFR or in any department other than Political Science. Of these, no more than 6 credits may be taken at the 400-level and no more than 3 combined credits may come from 596 and 599 listings.
- Communication and foreign language requirements, which will be determined by the student, the Political Science and African Studies Program advisers in accordance with the existing Political Science language requirements.

Foreign Language/Research Skills Competency Requirement

The language requirement for a student in the dual-title doctoral degree program will be determined by the student and the Political Science and African Studies program advisers in accordance with the existing Political Science language requirements. The Political Science Foreign Language/Research Skills Competency Requirement, contained in the Political Science Graduate Handbook, indicates that doctoral students must satisfy one of the following four criteria to demonstrate proficiency in foreign language and/or research skills:

1. Reading proficiency and translation skills in two foreign languages. Proficiency is certified by the School of Languages and Literatures (<http://sll.la.psu.edu/language-portal/language-proficiency-certification/>) at Penn State. The School's website details the procedures that students must follow to obtain certification.
2. Superior command of one foreign language. Superior command is defined as the ability to use the language to conduct field research abroad. This may include the ability to live and work in the relevant foreign country; the ability to converse with librarians, government officials, and other gatekeepers of documents and information; and the ability to conduct interviews with citizens or officials. There is no single test or criterion for demonstrating superior command of a foreign language. Rather, the student must provide to the Ph.D. committee letters from language instructors, faculty who have conducted fieldwork in the language in question, and similar documents so that its members can determine if the language skill is sufficient given the student's specialization and subfield.
3. Reading and translation proficiency in one foreign language plus a grade of B or higher in an advanced statistics course (i.e., material beyond that covered in PLSC 503) which has been approved by the student's doctoral adviser and the Director of Graduate Studies.
4. A statistical methods specialization consisting of three advanced statistics courses (each covering material beyond what is covered in PLSC 503). Students must receive a grade of B or higher in each class. The selection of courses must be approved by the student's doctoral adviser and the Director of Graduate Studies.

Qualifying Exam

The dual-title degree will be guided by the qualifying exam procedure of the Political Science graduate program. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable. There will be a single qualifying examination, containing elements of both Political Science and African Studies.

The qualifying examination committee for the dual-title degree will be composed of Graduate Faculty from Political Science and at least one Graduate Faculty member from the African Studies Program. The designated dual-title faculty member may be appointed from Political Science if that person holds a formal appointment with the African Studies program.

Ph.D. committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Political Science and African Studies dual-title doctoral degree student must include at least one member of the African Studies Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. The African Studies representative to the committee may serve as the Outside Field Member, and may also serve as the Outside Unit Member, if his or her primary appointment is in an administrative unit outside the unit in which the dissertation adviser's primary appointment is held.

If the chair of the committee representing Political Science is not also a member of the Graduate Faculty in African Studies, the member of the committee representing African Studies must be appointed as co-chair.

Comprehensive Exam

After completing all course work, doctoral students in the dual-title doctoral degree program in Political Science and African Studies must pass a comprehensive examination that includes written and oral components. The written portion of the comprehensive examination must include a substantial African Studies component, and one of the evaluators for the project must be affiliated with African Studies. The oral component of the comprehensive examination involves the defense of a dissertation prospectus, which must contain substantial African Studies content.

Dissertation and Dissertation Defense

Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. Students enrolled in the dual-title program are required to write and orally defend a dissertation on a topic that reflects their original research and education in Political Science and African Studies. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title Ph.D. in Political Science and Asian Studies

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Graduate students with research and educational interests in Asian studies may apply to the dual-title doctoral degree program in Political Science and Asian Studies. The goal of the dual-title degree in Political Science and Asian Studies is to enable graduate students from Political Science to acquire the knowledge and skills of their major area of

specialization in Political Science while at the same time gaining the perspective of Asian Studies.

In order to prepare graduate students for the competitive job market, this program provides them with a solid disciplinary foundation that will allow them to compete for the best jobs in their field. For such students the dual-title Ph.D. in Political Science and Asian Studies will add value to their degree and their status as candidates. It will produce excellent political scientists who are experts in Asian Studies as well. The dual-title degree Political Science and Asian Studies will build curricular bridges beyond the student's major field so as to provide a unique training regime for the global scholar.

Admission Requirements

For admission to the dual-title Ph.D. program, a student must first apply and be admitted to the Political Science graduate program and the Graduate School. After admission to the Political Science graduate program, a student must then apply for admission to the Asian Studies Program. Refer to the Admission Requirements section of the Asian Studies Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/asian-studies/>). Students already in their first and second years of the Political Science graduate program may also apply to the dual-title program. Doctoral students must be admitted into the dual-title degree program in Asian Studies prior to taking the qualifying examination in their primary graduate program.

In addition to the requirements of the Graduate School and Political Science, applicants interested in the dual-title program should also make their interest in the dual-title program known clearly on their applications and include remarks in their statement of purpose that address the ways in which their research and professional goals reflect an interest in interdisciplinary and Asian Studies-related research.

Degree Requirements

To qualify for an Asian Studies degree, students must satisfy the requirements of the Political Science program in which they are primarily enrolled. In addition, students must complete the degree requirements for the dual-title in Asian Studies, listed on the Asian Studies Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/asian-studies/>). Within this framework, final course selection is determined by the student, their Asian Studies adviser, and their Political Science program adviser.

Upon a student's acceptance by the Asian Studies admissions committee, the student will be assigned an Asian Studies academic adviser in consultation with the Asian Studies chair. As students develop specific scholarly interests, they may request that a different Asian Studies faculty member serve as their adviser. The student and adviser will discuss a program of study that is appropriate for the student's professional objectives and that is in accord with the policies of the Graduate School, the Political Science department and the Asian Studies program.

The doctoral degree in Political Science and Asian Studies is awarded only to students who are admitted to the Political Science doctoral program and admitted to the dual-title Ph.D. degree in Asian Studies. The minimum course requirements for the dual-title Ph.D. degree in Political Science and Asian Studies are as follows:

- A minimum total of 60 postbaccalaureate credits. Course work accepted for the M.A. in Political Science will count toward the 60-credit requirement. At least 45 credits, exclusive of dissertation, must be in political science.

- Completion of the designated core of courses in methodology (PLSC 501, PLSC 502, and PLSC 503).
- Completion of two, 1.5 credit seminars on teaching, writing, and professional development in political science.
- Completion of 15 hours of additional coursework (beyond the methodology and professionalization courses) in political science.
- Completion of 9 credits of elective coursework.
- 15 credits of Asia-related course work at the 400 or 500 level. At least 6 of these 15 credits will be from ASIA 501 and ASIA 502. As many as 6 may come from Political Science, as approved by the student's doctoral adviser and the Asian Studies Program director of graduate studies. The remaining 3 credits can be taken in ASIA or in any department other than Political Science.
- All-skills proficiency in one Asian Language

Particular courses may satisfy both the Political Science requirements and those of the Asian Studies program. Final course selection is determined by the student in consultation with their dual-title program advisers and their major program advisers.

Language Requirement

Students must show all-skills proficiency in one Asian language. All-skills proficiency in a foreign language can be assessed through the following mechanisms:

1. native speaker status,
2. completion of graduate-level research using the foreign language,
3. study abroad, and
4. independent study or examination.

All final determinations of all-skills proficiency will be made by a student's Asian Studies doctoral adviser in consultation with the Asian Studies Director of Graduate Studies.

In addition to demonstrating all-skills proficiency in one Asian language, a student must also:

- Complete two years' college study (or equivalent knowledge) of another Asian language OR
- Achieve alternative proficiency appropriate to the student's field.

Qualifying Exam

The dual-title degree will be guided by the qualifying exam procedure of the Political Science graduate program. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable. There will be a single qualifying examination, containing elements of both Political Science and Asian Studies.

The qualifying examination committee for the dual-title degree will be composed of Graduate Faculty from Political Science and at least one Graduate Faculty member from the Asian Studies Program. The designated dual-title faculty member may be appointed from Political Science if that person holds a formal appointment with the Asian Studies program.

Ph.D. committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Political Science and Asian Studies dual-title doctoral degree student must include at least one member of the Asian Studies

Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. The Asian Studies representative to the committee may serve as the Outside Field Member, and may also serve as the Outside Unit Member, if his or her primary appointment is in an administrative unit outside the unit in which the dissertation adviser's primary appointment is held.

If the chair of the committee representing Political Science is not also a member of the Graduate Faculty in Asian Studies, the member of the committee representing Asian Studies must be appointed as co-chair.

Comprehensive Exam

After completing all course work, doctoral students in the dual-title doctoral degree program in Political Science and Asian Studies must pass a comprehensive examination that includes written and oral components. The written portion of the comprehensive examination must include a substantial Asian Studies component, and one of the evaluators for the project must be affiliated with Asian Studies. The oral component of the comprehensive examination involves the defense of a dissertation prospectus, which must contain substantial Asian Studies content.

Dissertation and Dissertation Defense

Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. Students enrolled in the dual-title program are required to write and orally defend a dissertation on a topic that reflects their original research and education in Political Science and Asian Studies, and the chair or co-chair of the dissertation committee must be a graduate faculty member in Asian Studies. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title Ph.D. in Political Science and Social Data Analytics

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Political Science doctoral students seeking to attain and be identified with an interdisciplinary array of tools, techniques, and methodologies for social data analytics, while maintaining a close association with political science, may apply to pursue a dual-title Ph.D. in Political Science and Social Data Analytics.

Social data analytics is the integration of social scientific, computational, informational, statistical, and visual analytic approaches to the analysis of large or complex data that arise from human interaction. The dual-title Ph.D. aims to enable scientists who expand the capability of social data analytics, and use those capabilities creatively to answer important social scientific questions and to address grand social challenges, in both academic and nonacademic settings.

Admission Requirements

Students must apply and be admitted to the graduate program in Political Science and the Graduate School before they can apply for admission to the dual-title degree program. Applicants interested in the dual-title degree program may make their interest in the program known clearly on their applications to Political Science and include remarks in their statement of purpose that address the ways in which their research and professional goals in political science reflect an expanded interest in Social Data Analytics-related research. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Social Data Analytics dual-title program.

To be enrolled in the dual-title doctoral degree program in Social Data Analytics, a student must submit a letter of application and transcript, which will be reviewed by the Social Data Analytics Admissions Committee. An applicant must have a minimum grade point average of 3.0 (on a 4-point scale) to be considered for enrollment in the dual-title degree program. Students must be admitted into the dual-title degree program in Social Data Analytics no later than the end of the fourth semester (not counting summer semesters) of entry into the primary Ph.D. program and before taking the comprehensive exam.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the requirements of the Ph.D in Political Science. In addition, students must complete the degree requirements for the dual-title in Social Data Analytics, listed on the Social Data Analytics Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/social-data-analytics/>). Within this framework, final course selection is determined by the student in consultation with academic advisers from their primary graduate program adviser and Social Data Analytics.

The minimum course work requirements for the dual-title Ph.D. in Political Science and Social Data Analytics are as follows:

- Course work and other requirements of the Ph.D. in Political Science.
- SODA 501 (3 credits)
- SODA 502 (3 credits)
- 12 or more elective credits in Social Data Analytics from a list of courses maintained by the Social Data Analytics Committee. Collectively the elective credits must satisfy the following requirements:
 - (A) Core analytics distribution. 3 or more credits in courses focused on statistical learning, machine learning, data mining, or visual analytics. Courses approved as meeting this requirement are designated (A) on the list of approved electives.
 - (Q) Quantification distribution. 6 or more credits in courses focused on statistical inference or quantitative social science methodology. Courses approved as meeting this requirement are designated (Q) on the list of approved electives. (*A Political Science Ph.D. student would typically satisfy this distribution requirement as a function of completing the requirements of the Political Science Ph.D.*)
 - (C) Computational / informational distribution. 6 or more credits in courses focused on computation, collection, management, processing, or interaction with electronic data, especially at scale. Courses approved as meeting this requirement are designated (C) on the list of approved electives.
 - (S) Social distribution. 6 or more credits in courses with substantial content on the nature of human interaction and/or the analysis of data derived from human interaction and/or the social context or ethics or social consequences of social data analytics. Courses approved as meeting this requirement are designated (S) on the list of approved electives. (*A Political Science Ph.D. student would typically satisfy this distribution requirement as a function of completing the requirements of the Political Science Ph.D.*)
- Cross-departmental distribution.
 - 3 or more credits in approved courses with the prefix STAT or that of a primarily social science department. (*A Political Science Ph.D. student would typically satisfy this distribution requirement as a function of completing the requirements of the Political Science Ph.D.*)

- 3 or more credits in approved courses with the prefix IST, GEOG, or that of a primarily computer science or engineering department.
- 6 or more credits in approved courses outside Political Science.
- 3 or fewer credits in approved courses at the 400-level.

Students or faculty may request that the Social Data Analytics Committee consider approval of elective designations for any course, including temporary approvals for experimental or variable-title courses. Students are encouraged to take interdisciplinary courses that carry multiple (A), (Q), (C), (S) designations, as well as to select SODA electives that also meet requirements of the primary program. In particular, the 12 elective credits can be met with as few as 6 credits of appropriately chosen course work. Within this framework, final course selection is determined by the student in consultation with academic advisers from Political Science and Social Data Analytics. There is no formal maximum number of credits from the primary PLSC degree that can be double-counted toward the SODA degree. For those meeting the SODA elective requirement with the minimum of 12 credits, the outside-program minimum effectively limits the number of primary degree PLSC credits that count toward SODA at 6. Advising committees may limit the number of credits taken for the SODA dual-title that can count toward home degree requirements.

Qualifying Exam

The qualifying examination in Political Science satisfies the qualifying exam requirement for the dual-title degree program in Social Data Analytics.

Ph.D. committee Composition

The Ph.D. committee must conform to all requirements of the primary program and the Graduate Council. In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Political Science and Social Data Analytics dual-title doctoral degree student must include at least one member of the Social Data Analytics Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. The Social Data Analytics representative to the committee may serve as the Outside Field Member, and may also serve as the Outside Unit Member, if his or her primary appointment is in an administrative unit outside the unit in which the dissertation adviser's primary appointment is held.

If the chair of the committee representing Political Science is not also a member of the Graduate Faculty in Social Data Analytics, the member of the committee representing Social Data Analytics must be appointed as co-chair. The ideal arrangement then, is for a member of the Social Data Analytics Graduate Faculty with primary appointment in Political Science to act as dissertation chair, and for a member of the Social Data Analytics Graduate Faculty with primary appointment outside the administrative unit of the primary program to act as both Outside Field Member and Outside Unit Member.

Comprehensive Exam

After completing all course work, doctoral students in the dual-title doctoral degree program in Political Science and Social Data Analytics must pass a comprehensive examination that includes written and oral components.

The written portion of the comprehensive examination must include a substantial Social Data Analytics component, and one of the evaluators

for the project must be a member of the graduate faculty in Social Data Analytics.

The oral component of the comprehensive examination involves the defense of a dissertation prospectus, which must contain substantial Social Data Analytics content.

Dissertation and Dissertation Defense

Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. Students enrolled in the dual-title program are required to write and orally defend a dissertation on a topic that reflects their original research and education in Political Science and Social Data Analytics. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title M.A. and Ph.D. in Political Science and Women's, Gender, and Sexuality Studies

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Graduate students with research and teaching interests in gender and politics may apply to the dual-title master's or doctoral degree program in Political Science and Women's, Gender, and Sexuality Studies. The goal of the dual-title graduate degree program in Political Science and Women's, Gender, and Sexuality Studies is to enable graduate students from Political Science to acquire the knowledge and skills of their major area of specialization in Political Science while at the same time gaining the perspective of Women's, Gender, and Sexuality Studies.

In order to prepare graduate students for the competitive job market, this program provides them with a solid disciplinary foundation that will allow them to compete for the best jobs in their field. For such students the dual-title graduate degree in Women's, Gender, and Sexuality Studies will add value to their degree and their status as candidates. It will produce excellent political scientists who are experts in Women's, Gender, and Sexuality Studies as well. The dual-title graduate degree in Political Science and Women's, Gender, and Sexuality Studies will build curricular bridges beyond the student's major field so as to provide unique training for the interdisciplinary scholar.

Admission Requirements

Students must apply and be admitted to the graduate program in Political Science and the Graduate School before they can apply for admission to the dual-title degree program in Women's, Gender, and Sexuality Studies. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Women's, Gender, and Sexuality Studies dual-title program. Refer to the Admission Requirements section of the Women's, Gender, and Sexuality Studies Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/womens-gender-sexuality-studies/>). Doctoral students must be admitted into the dual-title degree program in Women's, Gender, and Sexuality Studies prior to taking the qualifying examination in their primary graduate program.

Dual-Title Master of Arts (M.A.)

Code	Title	Credits
Required Courses		
12 additional credits Political Science		12
PLSC 501	Methods of Political Analysis	3

PLSC 502	Statistical Methods for Political Research	3
WMNST 502	Global Feminisms	3
WMNST 507	Feminist Theory	3
WMNST 509	Feminist Pedagogies	3
	or WMNST 508 Feminist Methodologies	
Electives		
Select 3 elective credits in Women's, Gender, and Sexuality Studies approved courses (may double count if in political science field)		3
Culminating Experience		
Oral Exam ¹		
MA Essay ¹		
Total Credits		30

¹ Oral exam and MA essay defense as specified in the Department of Political Science Graduate Student Handbook.

Of these requirements, at least 21 credits must be at the 500 level. In addition there is a 6-credit maximum for independent study and a 10-credit maximum for transfer credits, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>). The student is expected to conduct research for the M.A. essay on a Women's, Gender, and Sexuality Studies topic.

For the dual-title Master of Arts degree in Political Science and Women's, Gender, and Sexuality Studies, the student's committee will include at least one Women's, Gender, and Sexuality Studies-affiliated faculty member.

Dual-Title Doctor of Philosophy (Ph.D.)

The Department of Political Science requires a minimum total of 60 postbaccalaureate credits for the Ph.D. At least 45 credits, exclusive of the dissertation, must be in political science. Course work accepted for the M.A. in Political Science at Penn State will count toward the department's 60-credit requirement. In the case of students who have earned credits in an advanced degree program at another university or in another department at Penn State, a maximum of 30 credits may count toward the 60-credit departmental requirement.

Code	Title	Credits
Required Courses		
15 credits in Political Science field		15
9 additional election credits		9
PLSC 501	Methods of Political Analysis	3
PLSC 502	Statistical Methods for Political Research	3
PLSC 503	Multivariate Analysis for Political Research	3
WMNST 502	Global Feminisms	3
WMNST 507	Feminist Theory	3
WMNST 509	Feminist Pedagogies	3
	or WMNST 508 Feminist Methodologies	
Electives		
9 elective credits in Women's, Gender, and Sexuality Studies approved courses (may double count if in political science field)		9
Ph.D. qualifying exam in major political science field		
Portfolio of Women's, Gender, and Sexuality Studies work		
Total Credits		51

Of these requirements at least 51 credits must be at the 500 level. In addition there is a 12-credit maximum for independent study.

Qualifying Examination Committee Composition

The qualifying examination committee for the dual-title degree will be composed of Graduate Faculty from Political Science and at least one Graduate Faculty member from the Women's, Gender, and Sexuality Studies Program. The designated dual-title faculty member may be appointed from Political Science if that person holds a formal appointment with the Women's, Gender, and Sexuality Studies program.

Qualifying Exam

There will be a single qualifying examination, containing elements of both Political Science and Women's, Gender, and Sexuality Studies. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

Ph.D. committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Political Science and Women's, Gender, and Sexuality Studies dual-title Ph.D. student must include at least two members of the Women's, Gender, and Sexuality Studies Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. The Women's, Gender, and Sexuality Studies representative to the committee may serve as the Outside Field Member, and may also serve as the Outside Unit Member, if his or her primary appointment is in an administrative unit outside the unit in which the dissertation adviser's primary appointment is held.

If the chair of the committee representing Political Science is not also a member of the Graduate Faculty in Women's, Gender, and Sexuality Studies, the member of the committee representing Women's, Gender, and Sexuality Studies must be appointed as co-chair.

Comprehensive Exam

After completion of required course work, doctoral students in the dual-title doctoral degree program must pass a comprehensive examination. The written portion of the comprehensive examination must include a substantial Women's, Gender, and Sexuality Studies component, and one of the evaluators for the project must be affiliated with Women's, Gender, and Sexuality Studies. The oral component of the comprehensive examination involves the defense of a dissertation prospectus, which must contain substantial Women's, Gender, and Sexuality Studies content.

Dissertation and Dissertation Defense

Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. Students enrolled in the dual-title program are required to write and orally defend a dissertation on a topic that reflects their original research and education in their home discipline and Women's, Gender, and Sexuality Studies. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Students must pass the Ph.D. qualifying and comprehensive exams and have their dissertation proposal approved as specified in the Department of Political Science Graduate Student Handbook.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated

in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Political Science (PLSC) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/plsc/>)

Learning Outcomes

1. **KNOW:** Graduates will demonstrate command of contemporary relevant theories and debates in the discipline of Political Science and in their specific Political Science subfields of focus.
2. **KNOW:** Graduates will demonstrate mastery of relevant literatures and cumulative knowledge in the discipline of Political Science and in their specific Political Science subfields of focus.
3. **THINK:** Graduates will demonstrate competence in the design and conduct of Political Science research.
4. **APPLY/CREATE:** Graduates will devise and execute independent original scholarly research projects relevant to the discipline of Political Science and in their specific Political Science subfields of focus.
5. **COMMUNICATE:** Graduates will demonstrate competency in presenting their scholarly output in written and oral formats that meet standards and conventions in the discipline of Political Science and in their specific Political Science subfields of focus.

6. **PROFESSIONAL PRACTICE:** Graduates will demonstrate knowledge of the professional norm, standards and ethics the discipline of Political Science.

Contact

Campus	University Park
Graduate Program Head	Lee Ann Banaszak
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Michael J Nelson
Program Contact	Kristy Michelle Boob 203 Pond Lab University Park PA 16802 kmc248@psu.edu (814) 863-1595
Program Website	View (http://polisci.la.psu.edu/)

Project Management

Graduate Program Head	Greg Filbeck
Program Code	PRMGT
Campus(es)	World Campus (M.P.M.)
Degrees Conferred	Master of Project Management (M.P.M.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=PRMGT)

The Master of Project Management (M.P.M.) is a graduate degree program that emphasizes all aspects of project management theory and practice. The M.P.M. is an interdisciplinary program that utilizes problem-based learning as well as web-based instructional methods to transcend time and space, and to support effective teaching and learning. The key areas of the M.P.M. include:

- planning, cost, and value management;
- project control;
- human issues in project management;
- strategic issues in project management; and
- commercial and procurement law as it relates to project management.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Only candidates who demonstrate high promise of success for graduate work are admitted to the M.P.M. program. Successful admission to the M.P.M. Program can be achieved in one of the following ways:

1. Applicants have a cumulative undergraduate grade-point average or major grade-point average of 3.0 or above and five or more years of relevant project management experience as approved by the program chair. Applicants must also submit a personal essay and 2 letters of recommendation for review.

2. Students may apply to enter the M.P.M. degree program upon successful completion of the Graduate Certificate in Project Management with a GPA of 3.0 or higher.

The M.P.M. program emphasizes application of course concepts to actual project management opportunities and problems. Therefore, students who currently are, or previously were, employed as project managers or project team members will derive the greatest benefit from the program. All applicants must provide evidence of sufficient current or previous work experience that will enable them to successfully complete course assignments requiring the application of course concepts to real project management situations. This evidence may be provided in either the form of two letters of recommendation from individuals who know the applicant in a professional capacity or through nomination to participate in the program by an appropriate official within the applicant's employing organization. Those who write letters of recommendation or submit nominations on behalf of the applicant will be asked to attest to the applicant's suitability for the program of study considering factors such as the applicant's length of employment, level and areas of work responsibility, personal qualities, career goals, maturity of purpose, and program requirements to apply course concepts to work-related issues. Applicants are encouraged to consult with the program chair concerning the suitability of their work experiences in relationship to program requirements.

All students must be computer literate and have ready and reliable access to a computer and the internet to successfully complete the M.P.M. program. They must know how to use word processing software, log on to an Internet provider, and use email. Additionally, M.P.M. students will use Microsoft Office in their course work that will require they have a working knowledge of Microsoft Office programs such as Word, Excel, Power Point, and Access. Access to fax facilities may be needed as an additional form of communications between student and instructor or between students.

Degree Requirements

Master of Project Management (M.P.M.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students complete eight required courses (24 credits) in which they apply course concepts to project management scenarios through the use of cases, simulations or actual situations in their employing organizations. The recommended maximum course load is 6 credits per semester for students working full-time. MANGT 510 must be taken in the first semester of study and is a prerequisite or co-requisite for all other courses in the program.

Code	Title	Credits
Required Courses		
MANGT 510	Project Management	3
MANGT 515	Cost and Value Management	3
MANGT 520	Planning and Resource Management	3
MANGT 525	Commercial Law and Project Procurement	3
MANGT 531	Organizations	3
MANGT 535	Interpersonal and Group Behavior	3
MANGT 540	Strategy: Corporate, Business and Project	3

All students must attend a minimum of one online orientation in order to complete the graduation requirements of the program.

Electives		
6 credits of elective courses. Electives may include additional program-approved courses or an applied research project focusing on some aspect of project management completed as an independent study.		6
Culminating Experience		
MANGT 575	Management of Projects (Capstone Project)	3
Total Credits		30

The program culminates with a capstone project, which is completed while enrolled in MANGT 575. MANGT 575 is a problem-based capstone course that integrates the themes necessary to appreciate the overall challenge of project management. The course includes a final, integrative and comprehensive project based on the identification and analysis of real project management problems from the students' work organizations. This written assignment requires the integration of theory from previous courses along with significant library and literature searches to analyze and propose solutions to these problems. MANGT 575 must be taken following completion of at least 18 credits. No more than one of the required courses may be taken concurrently with MANGT 575.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Management (MANGT) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/mangt/>)

Learning Outcomes

1. **MPM LG1 - Project Strategy:** Students will be able to connect project strategies with overall corporate strategies and manage the risks associated with actual project strategies
 - MPM LG1 OBJ 1 Students will understand how to develop an appropriate TOWS strategy matrix.
 - MPM LG1 OBJ 2 Students will recognize the value that a TOWS analysis provides (by applying to specific case scenarios).
 - MPM LG1 OBJ 3 Students will understand how risk affects project strategy and be able to manage it.
 - MPM LG1 OBJ 4 Students will identify critical stakeholders affected by as well as affecting the strategic decisions and actions of project management.
 - MPM LG1 OBJ 5 Students will understand the consequences of decisions/actions to and by stakeholders.
 - MPM LG1 OBJ 6 Students will develop well defined objectives for managing project strategies (using SMART c3 formats).
 - MPM LG1 OBJ 7 Students will understand and appropriately identify strategic objectives of a project.

2. **MPM LG2 - Planning, Resource Assignment, and Scheduling:** Students will be able to apply appropriate concepts and techniques to develop comprehensive project plans and solve scheduling and resource assignment problems.
 - MPM LG2 OBJ 1 Students will be able to develop comprehensive project plans including project scope documents and Work Breakdown Structures (WBS).
 - MPM LG2 OBJ 2 Students will be to develop comprehensive project schedules and are able to analyze the time/cost trade-offs in developing a project schedules.
 - MPM LG2 OBJ 3 Students will understand different types of project risks and how to manage them.
 - MPM LG2 OBJ 4 Students will understand how resource constraints impact project progress and analyze various resource allocation methods and how to effectively schedule resources.
 - MPM LG2 OBJ 5 Students will be able to monitor project progress by applying appropriate evaluation and control techniques.

3. **MPM LG3 - Project Leadership and Motivation:** Students will be able to identify, analyze, and solve issues surrounding employee performance in project teams.
 - MPM LG3 OBJ 1 Students will be able to define employee performance in terms of its dimensionality.
 - MPM LG3 OBJ 2 Students will be able to identify multiple drivers of employee performance and discuss the direct and indirect effects of the drivers using multiple theories/perspectives.
 - MPM LG3 OBJ 3 Students will be able to demonstrate a broad understanding of contemporary theory on each driver of employee performance.

4. **MPM LG4 - Solve Project Management Challenges:** Students will be able to critically evaluate project performance and identify key errors and opportunities and recommend relevant solutions to project problems
 - MPM LG4 OBJ 1 Students will be able to analyze projects and identify key strengths.
 - MPM LG4 OBJ 2 Students will provide evidence of their knowledge of the basic concepts associated with projects and project management.
 - MPM LG4 OBJ 3 Students will be able to describe techniques that have become fundamental to the current practice of project management.

5. **MPM LG5 - Commercial Law and Project Procurement:** Students will be able to identify and critically evaluate their project's and organization's supply chain.
 - MPM LG5 OBJ 1 The student will identify the need to negotiate flexibility in long-term contracts, such as changes in prices in the cost of goods over time and other terms, to facilitate productive working relationships within in the supply chain, including tier vendors.
 - MPM LG5 OBJ 2 The student will critically evaluate the legal impact of contract language with tier vendors and others in the supply chain.
 - MPM LG5 OBJ 3 The student will be able to recommend performance objectives for each phase of a supplier's contract payment terms.
 - MPM LG5 OBJ 4 The student will identify the critical role that subcontractors play in the successful performance of the supply chain.
 - MPM LG5 OBJ 5 The student will identify the critical risks in the procurement relationship and be able to draft appropriate contract provisions within the supply chain to address those risks.
 - MPM LG5 OBJ 6 The student will understand the powerful impact that differing commercial law in other nations can have in negotiating contracts when the supply chain incorporates an international setting.

Contact

Campus	World Campus
Graduate Program Head	Greg Filbeck
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Jeffrey Pinto
Program Contact	Lea Saunders 5101 Jordan Road Erie PA 16563 l1s5443@psu.edu (814) 898-6716
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/project-management-masters/overview/)

Psychology

Graduate Program Head	Kristin Buss
Program Code	PSY
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Dual-Title Ph.D. in Psychology and Language Science Dual-Title Ph.D. in Psychology and Social and Behavioral Neuroscience Dual-Title Ph.D. in Psychology and Social Data Analytics Dual-Title Ph.D. and M.S. in Psychology and Women's, Gender, and Sexuality Studies
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=PSY)

The graduate program in Psychology is characterized by individualized study leading to the Ph.D. degree. Emphasis is placed on research, teaching, and professional career development. Each student is associated with one of the five program areas offered in the department:

- *Clinical (Child and Adult tracks)*
- *Cognitive*
- *Developmental*
- *Industrial/Organizational*
- *Social*

Each student's particular interests dictate in part the course of study followed. Within all areas, research is an integral part of graduate study. Usually, the research is empirical, but it may be applied or basic, depending on the problem of interest.

The department has excellent resources, including well-equipped laboratories and an outstanding faculty. Opportunities exist for practice experience. For example, clinical students engage in supervised therapy in a departmentally based community mental health center, while industrial/organizational students participate in a practicum on projects for various organizations. Additional resources are available across the university, including an imaging center, high speed computing, and various training opportunities.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Applicants with superior undergraduate (particularly junior and senior years) or graduate grade-point averages will be considered for admission. Although a major in psychology is not required, it is common, and other applicants typically have a broad undergraduate background that includes 12 credits in psychology. Undergraduate study in psychology should include a course in statistics and a psychological methodology course. Previous research experience is important in most program areas. Students must write a statement of purpose, identify up to three

departmental faculty members of interest, and provide a writing sample and a current CV in the application materials.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The psychology department does not admit for the terminal master's degree. A minimum of 30 credits at the 400, 500, 600, or 800 level is required, with least 18 credits at the 500 and 600 level, combined. Core courses that must be completed are PSY 501 Seminar in General Psychology (1 cr.), PSY 507 Analysis of Psychological Data I (3 cr.), and PSY 508 Analysis of Psychological Data II (3 cr.). A master's thesis or a departmentally approved satisfactory scholarly paper is required and both usually involve original empirical research. Students who choose to complete a thesis must take a minimum of 6 credits of thesis research (PSY 600 or PSY 610). Students who choose to compete a scholarly paper must enroll in PSY 596 and must complete at least 18 credits in 500-level courses. Students should successfully propose a master's thesis or scholarly paper by the end of the first year and should successfully defend the thesis/paper by the end of their second year in the program. For students who choose to complete a thesis, the thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

All students must satisfactorily complete the department's English proficiency requirement as demonstrated by oral and written products in a section of PSY 501 (First-Year Orientation).

Students must complete, in the first 60 credits they accrue in the program, 6 credits in PSY 507 Analysis of Psychological Data I (3 cr.) and PSY 508 Analysis of Psychological Data II (3 cr.) with a grade of B or better. Students must complete 18 credits in a suitably selected major area; majors usually are defined by one of the five program areas noted on the Overview tab. The courses that satisfy the major area requirement can be chosen from a list of approved courses maintained by the graduate program office. In addition to the major area credits, students must complete a minimum of 12 credits outside the major area. Three options exist for completing these 12 credits: (1) completing four courses in APA-recommended breadth areas, (2) completing course work in all four of the other areas outside the major area, or (3) completing course work and doing a project in a particular area of expertise (a "minor") outside the major. Some areas may have additional recommended or required courses as well. All students must be involved with research supervised by at least two different faculty members. Students must pass the Ph.D. comprehensive examination by the time they have earned 70 graduate credits, or prior to their fourth year in the program, whichever comes first. Finally, the doctoral dissertation should be proposed and defended by the end of the fifth year, or in the case of students needing to meet accreditation or dual-title Ph.D. requirements, by the end of the sixth year. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School, and the student must pass a final oral examination (the dissertation defense).

Dual-Titles

Dual-Title Ph.D. in Psychology and Language Science

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Graduate students with research and educational interests in Psychology and Language Science may apply to the Psychology and Language Science dual-title Ph.D. program. The goal of the dual-title degree in Psychology and Language Science is to enable graduate students from Psychology to acquire the knowledge and skills of their major area of specialization in Psychology, while at the same time gaining the perspective and methods of the Language Sciences.

Admission Requirements

Students must apply and be admitted to the graduate program in Psychology and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Language Science dual-title program. Refer to the Admission Requirements section of the Language Science Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/language-science/>). Doctoral students must be admitted into the dual-title degree program in Language Science prior to taking the qualifying examination in their primary graduate program. Upon admission to the Psychology Program and with a recommendation from a Language Science program faculty member in the Department of Psychology, the student's application will be forwarded to a committee that will include the Director of the Linguistics Program, one of the Co-Directors of the Center for Language Science, and a third elected faculty member within the Center for Language Science. All three committee members will be affiliated with the Program in Linguistics. Upon the recommendation of this committee, the student will be admitted to the dual-title program in Language Science.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the Ph.D. degree in Psychology, listed above. In addition, students must complete the degree requirements for the dual-title in Language Science, listed on the Language Science Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/language-science/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Psychology and must include at least one Graduate Faculty member from the Language Science program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Psychology and Language Science. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>), the Ph.D. committee of a Psychology and Language Science dual-title Ph.D. student must include at least one member of the Language Science Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty

in Language Science, the member of the committee representing Language Science must be appointed as co-chair. The Language Science representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Psychology and Language Science. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title Ph.D. in Psychology and Social and Behavioral Neuroscience

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Psychology doctoral students who wish to engage in training and research that combines their interests in psychology with social and behavioral neuroscience may apply to pursue a dual-title Ph.D. in Psychology and Social and Behavioral Neuroscience (SBN). This dual-title program enables Psychology graduate students to obtain foundational graduate-level training in neuroscience as well as expertise in social and behavioral neuroscience theory, research, and methods.

Admission Requirements

To pursue a dual-title degree under this program, the student must first apply and be admitted to the graduate program in Psychology and the Graduate School. Applicants interested in the dual-title degree program may note their interest in their applications to Psychology. Students may apply for enrollment in the dual-title degree program in Social and Behavioral Neuroscience (<https://bulletins.psu.edu/graduate/programs/majors/social-behavioral-neuroscience/>) during their first year (second semester) or second year in their home department. To apply, a student must submit a letter of application, graduate and undergraduate transcripts, and a letter of recommendation from their graduate adviser. Applications will be reviewed by the Social and Behavioral Neuroscience Admissions Committee. The composition of the admissions committee will be determined by the program Steering Committee. At a minimum applicants must be in good standing in their home program and be recommended for admission by their graduate adviser. Doctoral students must be admitted into the dual-title degree program in Social and Behavioral Neuroscience prior to taking the qualifying examination in primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the requirements of the Ph.D in Psychology. In addition, students must complete the degree requirements for the dual-title in Social and Behavioral Neuroscience, listed on the Social and Behavioral Neuroscience Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/social-behavioral-neuroscience/>).

The qualifying examination committee must conform to all requirements of Psychology and the Graduate Council. In accordance with Graduate Council, the qualifying examination committee must include at least one member of the SBN Graduate Faculty. Faculty members who hold

appointments in both programs' Graduate Faculty may serve in a combined role.

The dual-title degree will be guided by the Qualifying Exam procedure of Psychology and the Graduate Council. In accordance with Graduate Council, there will be a single qualifying examination, assessing for both Psychology and the SBN dual-title program. Because students must first be admitted to Psychology before they may apply to and be considered for admission into the SBN dual-title graduate degree program, dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

The Ph.D. committee must conform to all requirements of Psychology and the Graduate Council. In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>), the Ph.D. committee of a Social and Behavioral Neuroscience dual-title doctoral degree student must include at least one member of the Social and Behavioral Neuroscience Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Social and Behavioral Neuroscience, the member of the committee representing Social and Behavioral Neuroscience must be appointed as co-chair.

The Comprehensive Exam procedure of Psychology will be followed. The SBN representative on the student's Ph.D. committee will participate in the writing and evaluation of the exam.

The dissertation must involve the integration of social and behavioral neuroscience and a research question of interest within the home department. The dissertation must be accepted by the Ph.D. committee, the heads of both graduate programs, and the Graduate School, and the student must pass a final oral examination (the dissertation defense).

Dual-Title Ph.D. in Psychology and Social Data Analytics

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Psychology doctoral students interested in having a degree that reflects interdisciplinary training in an array of tools, techniques, and methodologies for social data analytics, while maintaining a close association with psychology, may apply to pursue a dual-title Ph.D. in Psychology and Social Data Analytics.

Social data analytics is the integration of social scientific, computational, informational, statistical, and visual analytic approaches to the analysis of large or complex data that arise from human interaction. The dual-title Ph.D. program provides additional training with the aim of providing scientists with the skills required to expand the field of social data analytics, creatively answer important social scientific questions, and communicate effectively with both academic and nonacademic audiences.

Admission Requirements

Students must apply and be admitted to the graduate program in Psychology and the Graduate School before they can be admitted to a dual-title degree program. Applicants interested in the dual-title degree program may note their interest in their applications to Psychology. After admission to their primary program, students must apply for admission

to and meet the admissions requirements of the Social Data Analytics dual-title program. Refer to the Admission Requirements section of the Social Data Analytics Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/social-data-analytics/>). Students admitted to the psychology program will be admitted to the dual-title program in Social Data Analytics upon the recommendation of a Social Data Analytics Program faculty member in Psychology. Students must apply and be admitted to the dual-title degree program in Social Data Analytics prior to taking the qualifying exam.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the requirements of the Ph.D. in Psychology, listed above. In addition, students pursuing the dual-title Ph.D. in Psychology and Social Data Analytics must complete the degree requirements for the dual-title Social Data Analytics Ph.D., listed on the Social Data Analytics Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/social-data-analytics/>).

The qualifying examination committee for the dual-title degree will be composed of Graduate Faculty from Psychology and must include at least one Graduate Faculty member from Social Data Analytics. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Psychology and Social Data Analytics. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>), the Ph.D. committee of a dual-title doctoral degree student must include at least one member of the Social Data Analytics Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the committee representing Psychology is not also a member of the Graduate Faculty in Social Data Analytics, the member of the committee representing Social Data Analytics must be appointed as co-chair. The Social Data Analytics representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in both Psychology and Social Data Analytics. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title M.S. and Ph.D. in Psychology and Women's, Gender, and Sexuality Studies

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Penn State Psychology is one of only two programs in the U.S. to offer a dual-title degree Ph.D. in Women's, Gender, and Sexuality Studies and

Psychology. Graduate students also have the option of a [graduate](#) minor in Women's, Gender, and Sexuality Studies.

Admission Requirements

Students must apply and be admitted to the graduate program in Psychology and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Women's, Gender, and Sexuality Studies dual-title program. Refer to the Admission Requirements section of the Women's, Gender, and Sexuality Studies Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/womens-gender-sexuality-studies/>). Doctoral students must be admitted into the dual-title degree program in Women's, Gender, and Sexuality Studies prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Psychology. In addition, students must complete the degree requirements for the dual-title in Women's, Gender, and Sexuality Studies, listed on the Women's, Gender, and Sexuality Studies Bulletin page (<http://bulletins.psu.edu/graduate/programs/W/GRAD%20WMNST/>). Note that this Women's, Gender, and Sexuality Studies coursework counts as the Psychology Breadth requirements (12 credits toward minor specialization) and can also fulfill the requirement to work with two different faculty advisers.

For the dual-title M.S. degree in Psychology and Women's, Gender, and Sexuality Studies, the thesis or scholarly paper must reflect the student's education and interest in both Psychology and Women's, Gender, and Sexuality Studies. Of the three members of the M.S. thesis or scholarly paper committee, at least one member must be a member of the Women's, Gender, and Sexuality Studies Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the master's committee is not also a member of the Graduate Faculty in Women's, Gender, and Sexuality Studies, the member of the committee representing Women's, Gender, and Sexuality Studies must be appointed as co-chair.

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Psychology and must include at least one Graduate Faculty member from the Women's, Gender, and Sexuality Studies program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Psychology and Women's, Gender, and Sexuality Studies. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>), the Ph.D. committee of a Psychology and Women's, Gender, and Sexuality Studies dual-title Ph.D. student must include at least two members of the Women's, Gender, and Sexuality Studies Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Women's, Gender, and Sexuality Studies, the member of the committee representing Women's, Gender, and Sexuality Studies must be appointed as co-chair. The Women's, Gender, and Sexuality Studies representative on the student's Ph.D.

committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Psychology and Women's, Gender, and Sexuality Studies. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Psychology (PSY) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/psy/>)

Learning Outcomes

1. **Scientific Knowledge.** Students will demonstrate (a) integrated understanding of major psychological concepts, theories, and scientific foundations across multiple disciplines of psychology and

(b) the ability to apply psychological theories and methods in their research and/or practice.

2. **Critical Thinking.** Students will demonstrate (a) critical thinking skills in the evaluation and critique of empirical and theoretical research (in their specific area of specialization) (b) the ability to identify questions and solve issues in scholarly and professional environments (c) competence in formulating one's own scholarly opinions based on the integration of knowledge from diverse Psychological findings.
3. **Communication.** Students will demonstrate the ability to (a) communicate (verbal and written format) effectively in scholarly and professional environments (b) defend their ideas to others in research and practice (c) disseminate their knowledge and skills to enhance psychological awareness to the general population.
4. **Research Skills.** Students will demonstrate the ability to (a) critically analyze and integrate diverse research findings. (b) systematically identify and frame research questions, design a research study, analyze the resulting qualitative/quantitative data, and draw appropriate conclusions using scientific methodology and statistical analysis (c) organize their findings in written format, and/or present the findings in academic presentations or professional meetings.
5. **Diversity and Ethical Considerations.** Students will demonstrate (a) awareness of, and ability to work professionally with diverse individuals, groups, and communities, who represent various cultural and personal backgrounds and characteristics (b) knowledge and application of ethical principles related to the responsible conduct of research, as well as to scientific and professional activities with individuals, groups, and organizations.

Professional Licensure/Certification

Many U.S. states and territories require professional licensure/certification to be employed. If you plan to pursue employment in a licensed profession after completing this program, please visit the Professional Licensure/Certification Disclosures by State (<https://www.psu.edu/state-licensure-disclosures/>) interactive map.

Contact

Campus	University Park
Graduate Program Head	Kristin Buss
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Amy Dyanna Marshall
Program Contact	Christine Marie Andrus 125A Bruce V. Moore Building University Park PA 16802 cma18@psu.edu (814) 863-1721
Program Website	View (http://psych.la.psu.edu/graduate/)

Psychology of Leadership

Graduate Program Head	Kristin Ann Buss
Program Code	PSYLD
Campus(es)	World Campus (M.P.S.)
Degrees Conferred	Master of Professional Studies (M.P.S.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=PSYLD)

The M.P.S. degree in Psychology of Leadership is designed for individuals who are in the early and middle stages of their organizational careers, currently in or aspiring to leadership positions. The content of the program is appropriate for individuals employed in a wide range of functional specialties and industry sectors, including public agencies.

The M.P.S. degree in Psychology of Leadership examines the nature and role of leadership across varied organizational settings. Leadership is broadly defined as the process of influencing others (individually or collectively) in organizational settings. The program is based on well-supported psychological research and theory that have been shown to increase leadership effectiveness in work groups and organizations. While based in research, the program emphasizes the application of learned knowledge. Courses address the ways that various aspects and techniques of leadership can enhance the motivation, attitudes, and performance of individuals and teams in organizations.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Educational Background

Students who do not have a GPA of at least 3.0 will be considered on a case-by-case basis depending on the quality of their overall application. Applicants who are still completing their baccalaureate requirements at the time of application may be admitted to the Graduate School provisionally (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/provisional-admission/>), pending the awarding of the baccalaureate degree. Students are also expected to have a minimum of two years of full-time work experience prior to admission.

Core Application Packet

- Completed official online Graduate School application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) and payment of nonrefundable application fee.
- Statement of purpose: a 2-3 page essay articulating career and educational goals that demonstrates the student's written communication skills.
- A current vita or resume.
- Three letters of recommendation that attest to the student's readiness for graduate study and document the requisite minimum of two years of paid work experience. Letters must be submitted through the online application. Within the online application the student will be asked to enter the names and email addresses of three individuals who will be providing recommendations. Those individuals will receive a note via email asking them to complete a

brief form that will serve as the recommendation. The student should inform all recommenders they must submit the form in order for the application to be complete.

- Official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>)

Degree Requirements

Master of Professional Studies (M.P.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Total required credits for the MPS: 33 credits at the 400, 500, or 800 level; at least 27 must be at the 500 or 800 level, with at least 6 at the 500 level. Students must complete 9 credits of required courses and a 3-credit capstone course that serves as the culminating experience. Students choose the remaining 21 credits from a list of approved electives maintained by the program office.

Code	Title	Credits
Required Courses		
PSY 532	Psychological Foundations of Leadership	3
PSY 539	Foundations of Behavior, Motivation, and Attitudes at Work	3
PSY 833	Ethics and Leadership: Psychological and Social Processes	3
Electives		
Select 21 credits from list of approved electives maintained by the program office.		21
Culminating Experience		
PSY 894	Capstone Experience (Scholarly Paper)	3
Total Credits		33

The culminating experience provides students with an opportunity to apply their knowledge of the psychological theories and principles concerning leadership to an applied research project. The choice of research project topic will be mutually determined by the instructor and each student. A written paper based on the applied project is required and must contain project description, analysis, and interpretation of its findings, as well as a review of relevant published literature.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)

- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Psychology (PSY) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/psy/>)

Learning Outcomes

1. Graduates will be able to explain relevant theories underlying and related to the psychology of leadership.
2. Graduates will be able to apply psychological theories to leadership issues and situations.
3. Graduates will be able to synthesize theories to communicate a comprehensive understanding of the psychology of leadership.
4. Graduates will be able to analyze leadership situations in order to evaluate leader behaviors and predict their effectiveness in self and others.
5. Graduates will be able to analyze leadership situations with respect to ethics and understand the implications of leader behavior in self and others.
6. Graduates will be able to evaluate their own leadership behaviors and plan steps for improvement.
7. Graduates will be able to plan strategies for improving leadership and organizational effectiveness.

Contact

Campus	World Campus
Graduate Program Head	Kristin Buss
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Greg Edward Lovinsky
Program Contact	Mike Joyce 140 Moore Bldg University Park PA 16802 mjj12@psu.edu (814) 865-0704
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-psychology-leadership-masters/overview/)

Public Administration

Graduate Program Head	L. Marvin Overby
Program Code	PADM
Campus(es)	Harrisburg (Ph.D., M.P.A.) World Campus (M.P.A.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Public Administration (M.P.A.) Joint J.D./M.P.A. with Dickinson Law
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=PADM)

The mission of the Master of Public Administration (MPA) program is to advance the knowledge and skills necessary to manage and lead organizations engaged in public service in democratic and diverse societies. As the MPA program intends to assist those interested in public service careers in public management, public policy, and nonprofit fields, the curriculum balances theoretical and applied concepts to build students' abilities to understand, analyze, and manage environments with real-world experiences. The MPA program is accredited by the National Association of Schools of Public Affairs and Administration (NASPAA).

The mission of the Ph.D. program in Public Administration is to provide advanced graduate education in theory and research in the field to prepare students for academic, research, and advanced professional careers in public administration. Each student is expected to graduate with:

1. Research experience working with public administration faculty
2. Experience in presentation of scholarly papers and posters at national and regional conferences
3. Experience in developing, authoring, or co-authoring with a faculty member, and submitting at least one article for a refereed publication
4. Teaching experience at the college/university level

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to

Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Master of Public Administration (M.P.A.)

Applicants who are still completing their baccalaureate requirements at the time of application may be provisionally admitted (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/provisional-admission/>) to the Graduate School conditional on the awarding of the baccalaureate degree.

Admission to the MPA program is based on clear suitability for the program as demonstrated by the application as a whole, including the following:

- a completed application with the nonrefundable application fee;
- official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>);
- a statement of career and educational goals;
- a successful undergraduate record with a grade-point average of 3.00 (either as the cumulative GPA or for the last 60 hours of relevant course work);
- satisfactory scores on the Graduate Record Examination (GRE), Graduate Management Admission Test (GMAT), or Law School Admission Test (LSAT) if the GPA is less than 3.0; and
- recommendations from three references.

Doctor of Philosophy (Ph.D.)

Individuals with superior academic records and a strong interest in careers emphasizing research and scholarship are encouraged to apply to the program. The program typically admits a Ph.D. cohort of full-time students to begin each fall semester.

Admission to the Ph.D. program is based on the applicant's undergraduate and graduate academic records, standardized test scores, letters of reference, and the compatibility of their backgrounds and interests with those of the program faculty members, as expressed in the applicant's statement of goals and research interests. All applicants must have completed a master's degree. A completed master of public administration (M.P.A.) degree is preferred, but students with master's degrees in related areas (political science, public policy, economics, sociology, anthropology, social work, business management, and health administration, for example) or Juris Doctorate degrees (law) will also be considered.

Application Deadlines

There are two deadlines for applications for the fall semester of the following academic year: **January 15** and **March 15** of each year. For those applicants seeking research or teaching assistantships, the deadline to submit all application materials is January 15. Late applications may be considered if assistantships are still available. Applicants who wish to finance their education with their own funds or other sources (foreign governments that fund international students for Ph.D. studies in the United States and other funding agencies, such as Fulbright commissions) must submit all application materials by March 15.

Application Package

A complete application must include:

1. A completed online Graduate School application (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>)

2. Payment of a non-refundable application fee
3. Official Graduate Record Examination scores (verbal, quantitative, and analytical) taken within the five years prior to the date of application
4. A resume that includes:
 - a. work experience,
 - b. volunteer activities,
 - c. academic and professional honors,
 - d. honorary societies,
 - e. extracurricular activities,
 - f. offices held,
 - g. any publications and
 - h. other significant activities
5. A statement of goals and research interests, including evidence of research aptitude and interest as well as “fit” with the faculty interests in the Ph.D. program at Penn State Harrisburg. The applicant should make the case why this Ph.D. program at Penn State Harrisburg would be a good fit for them
6. A writing sample that reflects the applicant’s background in conducting academic research and potential to conduct academic research in the future
7. At least three letters of recommendation, preferably from faculty members who can comment upon the applicant’s potential as a doctoral student
8. Official transcripts from all post-secondary institutions attended. (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>)

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of Public Administration (M.P.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students may begin the program in any semester. Three courses (or 9 credits) per semester are considered a normal course load for full-time students. Part-time students typically take one or two 3-credit courses each semester and one or two courses during the summer session to maintain steady progress toward the degree. The program, including an internship in a public agency or nonprofit organization for those without three years of managerial, supervisory, or professional experience, requires eighteen to twenty-four months of full-time study, or three to five years on a part-time basis.

Time Limitation

All degree requirements for the Master of Public Administration must be met within five years of admission to degree status.

The M.P.A. degree program requires a minimum of 39 credits at the 400, 500, or 800 level, with a minimum of 18 credits at the 500 or 800 levels, and at least 6 credits at the 500 level:

- 21 credits in core courses,
- 12 credits in electives,
- 3 credits for the capstone course that serves as the culminating experience for the degree, and
- a 3 credit internship.

The 3-credit internship may be waived at the discretion of the program for students who have at least two years of full-time relevant work experience that consists of supervisory, managerial, or professional work, or who gain this experience while enrolled in the program. Students for whom the internship requirement is waived can complete the program with a minimum of 36 credits. Up to 6 credits of 400-level courses may be taken as electives, with the approval of an adviser.

Code	Title	Credits
Required Courses		
PADM 800	Foundations of Public Administration	3
PADM 502	Governmental Fiscal Decision Making	3
PADM 503	Research Design	3
PADM 504	Data Analysis for Policy and Administration	3
PADM 505	Human Resources in the Public and Nonprofit Sectors	3
PADM 507	Introduction to Public Policy Analysis	3
PADM 510	Organization Behavior	3
<i>Internship in Public Administration</i>		
PADM 595	Internship	3
Electives		
With the faculty adviser’s approval, a student selects 12 credits of electives from a list of approved electives maintained by the program office.		12
Culminating Experience		
PADM 594	Research Topics (Capstone Course)	3
Total Credits		39

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A Ph.D. student must first successfully complete the prerequisite courses specified by the program to make up for deficiencies, if any exist. After these are completed, students must take a minimum of 36 credits:

- four 3-credit foundation courses,
- four 3-credit specialization area courses, and
- four 3-credit research methods courses.

All doctoral students must pass a qualifying examination, a comprehensive written and oral examination, and a final oral examination (the dissertation defense). To earn the Ph.D. degree, doctoral students must also write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Foundations of Public Administration

All the students in the program will be required to take the following foundational courses before they are eligible to take the qualifying examination:

Code	Title	Credits
Required Courses		
PADM 570	Scope and Methods of Public Administration	3
PADM 571	Seminar in Organizational Theory	3
PADM 572	Research and Theory in Public Budgeting and Finance	3
PADM 573	Research and Theory in Public Policy and Governance	3
Total Credits		12

Specialization Area Courses

In consultation with the student's adviser and Ph.D. committee, each doctoral student will develop a public administration specialization that consists of four 3-credit courses. These specialization areas are not pre-defined. They may be tailor-made by the student and his/her committee, based on the student's interests and the availability of the courses in the School of Public Affairs and other colleges and graduate programs at Penn State. Examples of possible specialization areas are

- public and nonprofit management,
- organizations and human resource management,
- public budgeting and finance,
- public policy analysis,
- state and local government administration,
- criminal justice,
- health administration, and
- homeland security.

Research Methods Courses

Students are required to take four 3-credit research methods courses. The following three research methods courses are required for all Public Administration Ph.D. students:

Code	Title	Credits
Required Courses		
PADM 503	Research Design	3
PADM 504	Data Analysis for Policy and Administration	3
PADM 575	Advanced Research Design	3
Total Credits		9

Students also will select one in-depth 3-credit research methods course on the basis of their research interests (quantitative, qualitative, or mixed methods), suitability of the courses in preparing students for their dissertation studies, and the availability of the courses.

Students may find suitable courses in the Ph.D. program in Public Administration or other graduate programs at Penn State. This one in-depth methods course should be approved in advance by the student's Ph.D. committee. A student's committee may also allow them to take an in-depth methods course that is offered by other universities or research institutions if an equivalent course cannot be found within Penn State, if the equivalency of this course to a 3-credit graduate-level course offered at Penn State can be verified by Graduate Enrollment Services, and if the costs of taking this course can be covered by the student or another arrangement can be made to cover the cost.

Qualifying Examination

Only students who complete 18 credits, including the required courses in the Foundations of Public Administration successfully, with a minimum 3.0 GPA, may take the qualifying examination. The qualifying examination

will cover topics about the intellectual history and enduring questions in the field. Many of these subjects are covered in the required foundational doctoral courses; they include such topics as public administration and democratic theory, public organizations and management, and constitutional and legal foundations. The exam is written and graded by the Public Administration Graduate Faculty.

Comprehensive Examination

Upon successful completion of the specialization courses and research methods courses, with a minimum 3.0 GPA, a doctoral student takes a comprehensive written and oral examination. Comprehensive examinations are administered by the student's Ph.D. committee. In comprehensive examinations, students are tested about the contents of their specialization areas and they will be required to propose a research design on a relevant topic.

Dissertation

After passing the comprehensive examination, a student must work with his or her adviser and Ph.D. committee to develop a full dissertation proposal within three months of the exam. Once the Ph.D. committee approves the full proposal, dissertation research can begin. Students will be required to conduct their dissertation research and write and defend their dissertations in accordance with Graduate Council policy and as agreed on by their Ph.D. committees. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School, and the student must pass a final oral examination (the dissertation defense).

Grade Point Average and Time Limit

Full-time students are expected to finish the program in four to five years. Graduate Council policy requires that a student must complete the program within eight years after passing the qualifying examination. The Ph.D. program in Public Administration requires that students have at least a 3.00 grade-point average in order to graduate.

Joint Degrees

Joint J.D./M.P.A. with Dickinson Law

Requirements listed here are in addition to requirements listed in GCAC-211 Joint Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-211-joint-degree-programs/>).

Penn State Dickinson Law and the School of Public Affairs, Penn State Harrisburg, the Capital College, offer a joint degree program leading to the degrees of Juris Doctor, granted by Dickinson Law, and Master of Public Administration, granted by Penn State Harrisburg.

Admission Requirements

In order to be admitted to the program, students must first be admitted to Penn State Dickinson Law under its regular admission procedures. Subsequently, the student must be recommended for admission to the M.P.A. program by Dickinson Law, and must apply for admission to the M.P.A. degree program as described on the Admission Requirements tab. Penn State Harrisburg will make independent admissions decisions as to all joint degree applicants.

Admissions requirements and applications for Dickinson Law are available at the Admissions & Aid (<https://dickinsonlaw.psu.edu/admissions-aid/>) section of its website.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the J.D. program are listed on

the Dickinson Law website (<https://dickinsonlaw.psu.edu/academics/curriculum/jd-program/>). Degree requirements for the M.P.A. degree are listed on the Degree Requirements tab.

A maximum of 9 credits of Dickinson Law course work may be double-counted for credit toward the M.P.A. degree at Penn State Harrisburg, subject to program approval based on relevance to the M.P.A. degree.

A maximum of 9 credits of M.P.A. course work with a grade of B or better may be double-counted for credit toward the J.D. degree at Dickinson Law, subject to approval by Penn State Dickinson Law.

A student in the joint degree program can graduate with one degree prior to completing the other, if all requirements for that degree have been completed. Students must earn at least a 3.0 grade-point average to be eligible for the M.P.A. degree. If students accepted into the joint degree program are unable to complete the J.D. degree, they are still eligible to receive the M.P.A. degree if all the M.P.A. degree requirements have been satisfied.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Qualified Ph.D. students will be supported with 9-month merit-based research or teaching assistantships. The assistantship granted to a student may be renewed at the end of each academic year, based on the student's academic performance in the program. While these are not guaranteed, funding opportunities may also be available for admitted students during the summer semesters. Such opportunities may include, but are not limited to, teaching and involvement in faculty-sponsored research. Students may also apply for other financial aid programs through the University's Office of Student Aid (<http://studentaid.psu.edu/>).

In addition, the program faculty may admit to the program qualified full-time students who will finance their educations with scholarships from sources outside Penn State or with personal funds. These sources may include foreign governments that fund international students for Ph.D. studies in the United States and other funding agencies, such as Fulbright commissions.

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Public Administration (PADM) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/padm/>)

Learning Outcomes

1. Graduates will demonstrate in-depth **knowledge of the foundations** (major concepts and theories) of public administration and policy processes.
2. Graduates will demonstrate in-depth **knowledge of relevant research methods** to be used in their dissertation studies and publications.
3. Graduates will demonstrate in-depth **knowledge of the specialization area** of their choice.
4. Graduates will demonstrate their ability to **apply relevant research methods** in their class papers and dissertation studies.
5. Graduates will demonstrate their ability to **communicate their conceptual knowledge** of foundational topics, specialization area topics, and research methods in written and oral forms.
6. Graduates will demonstrate their **analytical and critical thinking abilities** on the topics relevant to public policymaking and public administration processes.
7. Graduates will demonstrate their **knowledge of the rules of ethics and professional conduct** in public policy and administrative processes and the **knowledge of ethical research practices** and apply them in their studies in the program.

Contact

Campus	Harrisburg
Graduate Program Head	L. Marvin Overby
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Dan Mallinson
Program Contact	Autumn D Wise School of Public Affairs 777 West Harrisburg Pike, 159W Olmsted Bldg. Middletown PA 17057-4898 adw5533@psu.edu (717) 948-6773
Program Website	View (https://harrisburg.psu.edu/public-affairs/public-administration/master-public-administration/)
Campus	World Campus
Graduate Program Head	L. Marvin Overby
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Dan Mallinson
Program Contact	Autumn D Wise School of Public Affairs 777 West Harrisburg Pike, 159W Olmsted Building Harrisburg PA 17057 adw5533@psu.edu (717) 948-6773
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/public-administration-masters/overview/)

Public Health

Graduate Program Head	Cheryl Thompson
Program Code	PH
Campus(es)	Hershey (M.P.H., Dr.P.H.) World Campus (M.P.H.)
Degrees Conferred	Doctor of Public Health (Dr.P.H.) Master of Public Health (M.P.H.) Integrated B.S. in Biobehavioral Health and M.P.H. in Public Health Integrated B.S. in Health Policy and Administration and M.P.H. in Public Health Integrated B.S. in Kinesiology and M.P.H. in Public Health Integrated B.S. in Nutritional Sciences and M.P.H. in Public Health Joint J.D./Dr.P.H. with Dickinson Law Joint J.D./M.P.H. with Dickinson Law Joint J.D./M.P.H. with Penn State Law Joint M.D./M.P.H. with the College of Medicine Joint M.D./M.P.H. with Taipei Medical University Joint Pharm.D./M.P.H. with Taipei Medical University View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=PH)
The Graduate Faculty	

The Master of Public Health (M.P.H.) in Public Health program is a professional degree program that builds knowledge and skills in the areas of systems thinking, evidence-based public health, leadership, program planning and management, public health and health systems, communication, and interprofessional practice. In addition, the M.P.H. in Public Health program advances expertise in community and behavioral health, epidemiology and biostatistics, global health, and health systems organization and policy. The M.P.H. degree leads to careers in a wide variety of fields and settings, including local, state, and federal government agencies; health care settings; health insurance industry; health services networks; nonprofits; and the pharmaceutical industry.

The Doctor of Public Health (Dr.P.H.) in Public Health program is a professional degree program that provides advanced public health education and training to prepare its graduates for evidence-based practice and leadership in the application of translational science and implementation research findings. It allows graduates to pursue career opportunities in the federal, state, and local government, as well as in the non-profit, academic, and private sectors. Educationally it places an emphasis on discovery, teaching, integration, and application with a primary purpose of bridging research and practice to protect and improve the public's health. The Dr.P.H. builds on Master of Public Health (M.P.H.) competency domains and, as a professional degree, integrates public health practice and project-based learning with local, state, and federal networks to enrich learning in health policy and program development and implementation. The Dr.P.H. program of study includes course work, an advanced field experience, and integrative doctoral research and

provides an opportunity for further specialization within a specified cognate.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Master of Public Health (M.P.H.)

Admission to the Penn State M.P.H. Program is granted jointly by the M.P.H. Program and the Graduate School at Penn State.

For admission to the M.P.H. Program, applicants must submit:

- Completed online Graduate School application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) with nonrefundable application fee
- Resume or curriculum vitae
- Statement of purpose
- Two letters of recommendation
- Official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>)

Doctor of Public Health (Dr.P.H.)

For admission to the Dr.P.H. Program, applicants must submit:

- Completed online Graduate School application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) with nonrefundable application fee
- Three recommenders to provide letters of academic and professional reference
- Statement of purpose
 - Describe why you want to pursue a Dr.P.H., how you plan to use your education and training, the needs and/or challenges you perceive as important in your field of study, and any personal qualities, characteristics, skills and experiences you believe will enable you to be successful in public health
- Official Graduate Record Examination (GRE) scores taken within the past five years
- Official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>)
- CV or resume

Degree Requirements

Master of Public Health (M.P.H.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

M.P.H. students must complete a total of 42 credits of graduate level course work, the majority of which are 500 level courses, specifically:

- 24 credits in prescribed courses, including:
 - 18 credits of core classroom-based courses
 - 3 credit practicum experience
 - 3 credit capstone course
- 18 credits in elective courses

The Capstone Course (PHS 894) provides the students with the knowledge and skills to design, carry out, and present a scholarly public health project based upon competencies gained in previous courses. Topics include defining a scholarly project, selecting a topic and project type, describing the problem, reviewing the literature, identifying project methodology, presenting project results, ethics and scholarly work, writing and critiquing scholarly work, and creating and delivering a poster presentation.

Code	Title	Credits
Required Courses		
PHS 809	Principles of Public Health	3
PHS 504	Behavioral Health Intervention Strategies	3
or BBH 504	Behavioral Health Intervention Strategies	
PHS 520	Principles of Biostatistics	3
or STAT 500	Applied Statistics	
PHS 539	Qualitative Health Research Methods	3
Select 3 credits from the following:		
PHS 550	Principles of Epidemiology	3
HPA 540	Epidemiological Applications in Health Services Research	3
STAT 507	Epidemiologic Research Methods	3
PHS 571	Health Services Organization and Delivery	3
or HPA 520	The U.S. Health Care Industry and Health Services Organizations	
PHS 895A	Master of Public Health Internship	3
Additional Courses		
Select 18 credits from a list of approved courses that is maintained by the graduate program office. Multiple tracks of specialization are available.		18
Culminating Experience		
PHS 894	Capstone Experience (Capstone Course)	3
Total Credits		42

Doctor of Public Health (Dr.P.H.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Dr.P.H. students must complete a minimum of 60 credits of graduate-level course work beyond a master's degree, the majority of which are 500-level and 800-level courses, specifically:

- 27 credits in prescribed, core classroom-based courses
- 18 credits in elective courses
 - 9 credits of track elective courses
 - 9 credits of general (cognate) elective courses
- 15 additional credits
 - 6 credits of Advanced Field Experience
 - 9 credits of Integrative Doctoral Research

Code	Title	Credits
Required Courses		
PHS 536	Health Survey Research Methods	3
PHS 575	Integrative Seminar in Public Health Leadership	3
PHS 576	Integrative Seminar in Public Health Policy	3
PHS 577	Integrative Seminar in Social & Behavioral Determinants of Health	3
PHS 554	Statistical Methods in Public Health I	3
PHS 555	Statistical Methods for Public Health II	3
ADTED 550	Qualitative Research in Adult Education	3
PHS 806	Public Health Ethics	3
PHS 892	Directed Studies in Public Health	3
PHS 895B	Advanced Field Experience	6
Electives		
Select 18 credits from a list of approved courses that is maintained by the graduate program office. Multiple tracks of specialization are available.		18
Culminating Experience		
PHS 896A	Integrative Doctoral Research I	6
PHS 896B	Integrative Doctoral Research II	3
Total Credits		60

Dr.P.H. students must meet Penn State doctoral degree requirements as outlined in GCAC-700 Professional Degree Requirements (<http://gradschool.psu.edu/graduate-education-policies/>), including qualifying examinations, English competencies, and professional doctoral committee composition. Dr.P.H. students must also meet the following additional Dr.P.H.-specific requirements.

The Dr.P.H. degree is conferred in recognition of advanced preparation of a high order for work in the profession of education as evidenced by:

1. Satisfactory completion of a prescribed period of study;
2. Ability to apply translational science and implementation research findings in evidence-based public health practice;
3. Successful performance of qualifying and comprehensive examinations, covering public health core areas of study and a field of specialization; and
4. The preparation and acceptance of integrative doctoral research.

Residency requirement

The Doctor of Public Health requires 24 core credits to be taken in residence as a registered student engaged in academic work at the Hershey and Harrisburg campuses.

Additional Course Requirements for Applicants without a Master of Public Health

Applicants must have a graduate (e.g. master's) or advanced professional (e.g., M.D.) degree. Applicants without a Master of Public Health or related degree are required to take core courses to ensure a firm foundation in discipline-specific M.P.H. competency domains. These foundation courses include:

Code	Title	Credits
PHS 504	Behavioral Health Intervention Strategies	3
PHS 520	Principles of Biostatistics	3
PHS 550	Principles of Epidemiology	3

PHS 571	Health Services Organization and Delivery	3
PHS 809	Principles of Public Health	3

For applicants entering the program without a Master of Public Health, the minimum credits required for the Dr.P.H. degree will include these 15 credits of foundation courses, for a minimum total of 75. Some or all of the foundation courses may be waived based on previous graduate-level course work, in which case the total credits required for the degree may be reduced in an equivalent manner, down to the base minimum of 60 credits. Students must petition the head of the graduate program to obtain a waiver for the foundation courses, and students' transcripts will be reviewed to assess their eligibility for a waiver.

Comprehensive Examination

Upon completing all core and most cognate course work, Dr.P.H. students will take comprehensive exams to ensure they meet Dr.P.H. core and track program competencies. Comprehensive exams will be overseen and evaluated by students' professional doctoral committee.

Integrative Doctoral Research

Dr.P.H. students will be required to complete two major components for their Dr.P.H. integrative experience: two publishable-quality manuscripts and a doctoral portfolio.

With guidance from their doctoral adviser and professional doctoral committee, students will develop two manuscripts that comprehensively address, generate, and/or interpret and evaluate knowledge applicable to public health practice. Manuscripts are encouraged to be of an applied nature and must demonstrate students' abilities to conduct independent research on a contemporary public health issue. Students will demonstrate the application of advanced public health practice skills and knowledge in the design and execution of a scholarly project, the analysis and interpretation of the findings, and the application of the new knowledge to advance public health practice. This work should contribute to the evidence base of public health practice, be of publishable quality, and demonstrate critical thinking and rigorous analytic strategies.

Throughout their doctoral program, students will develop a doctoral portfolio that will document how Dr.P.H. courses, advanced field experience, other experiential learning, and self-knowledge has informed their leadership style and approach to integrating evidence-based research into public health practice. Components of the portfolio may include, but are not limited to, research (e.g., publications, conference presentations), teaching (academic and non-academic, community-based teaching), and field and other service learning experiences. Portfolios will require reflection on in-class and out-of-class experiences and demonstrate students' broad public health knowledge, specialized knowledge, translation of this knowledge into evidence-based public health practice, and leadership style. Integrative Doctoral Research will demonstrate the following competencies:

- data and analysis,
- communication, systems thinking,
- leadership,
- critical thinking, and
- problem solving.

Written and oral presentation of this work will be required.

Integrated Undergrad-Grad Programs

Integrated B.S. in Biobehavioral Health and M.P.H. in Public Health

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Biobehavioral Health with the M.P.H. in Public Health offered at the following campuses:

Undergraduate Degree

- Greater Allegheny
- Harrisburg
- Lehigh Valley
- New Kensington
- University Park
- World Campus

Graduate Degree

- Hershey
- World Campus

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students must apply to and meet the admissions requirements of the Graduate School, as well as the graduate program in which they intend to receive their master's degree. Admission to the IUG and the M.P.H. degree program is granted jointly by the M.P.H. Program and the Graduate School at Penn State. The requirements presented here are in addition to the Graduate School's requirements for admission. To be eligible to apply to the IUG program, applicants must meet the following requirements:

Requirements

GPA

Guidelines

- Cumulative GPA: 3.25 or greater
- GPA in BBH major courses: 3.0 or greater

Education

- Enrollment in the B.S. in BBH degree program
- Completion of the following courses: BBH 101, BBH 311 or BBH 316, STAT 200 or STAT 250, PSYCH 100, BIOL 110, BIOL 141

The M.P.H. in Public Health program will continue to monitor the academic performance of undergraduate students who apply and are admitted to the IUG program. If students fall below the GPA requirements during the undergraduate portion of the IUG plan of study, they may be put on probation or terminated from the IUG program altogether.

IUG application requirements include the following:

- Completed online Penn State Graduate School application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) with nonrefundable application fee
- Resume or curriculum vitae
- Statement of purpose
- Two letters of recommendation, including one from the student's undergraduate academic adviser that proves the academic adviser has worked with the student to develop a draft IUG plan of study
- Official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>)
- Preliminary draft plan of study. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.

Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. Students can be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree.

Degree Requirements

B.S./M.P.H. degree requirements are the same as that of the standalone M.P.H. degree program. Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.S. in Biobehavioral Health are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.P.H. degree are listed on the Degree Requirements tab.

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.P.H. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Up to 15 credits of M.P.H. degree course work will double count towards the B.S. in Biobehavioral Health degree requirements. A minimum of 50% of the double-counted credits must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
PHS 504 or BBH 504	Behavioral Health Intervention Strategies	3
PHS 520 or STAT 500	Principles of Biostatistics Applied Statistics	3
PHS 550 or STAT 507	Principles of Epidemiology Epidemiologic Research Methods	3
PHS 571	Health Services Organization and Delivery	3

or HPA 520	The U.S. Health Care Industry and Health Services Organizations	
PHS 809	Principles of Public Health	3
BBH 407	Global Health Equity	3
BBH 416	Health Promotion II: Planning, Implementation, and Evaluation	3
BBH 432	Biobehavioral Aspects of Stress	3
BBH 446	Human Sexuality as a Health Concern	3
BBH 451	Pharmacological Influences on Health	3
BBH 452	Women's Health Issues	3
BBH 458	Critical Feminist Issues in Reproduction	3

Advising of Students

The M.P.H. in Public Health program will assign IUG students with an academic adviser. This adviser is in addition to the one assigned to them as undergraduate students enrolled in the B.S. in Biobehavioral Health degree program. The M.P.H. in Public Health adviser will be a faculty member from the Department of Public Health Sciences at the Penn State College of Medicine in Hershey, PA who is a member of the Graduate Faculty. The academic adviser will be assigned upon entry into the M.P.H. degree program. If advisers are on different campuses than their respective students, they will communicate with their students through a combination of videoconferencing (via Skype or other mechanism), phone, email, and in person meetings.

Integrated B.S. in Health Policy and Administration and M.P.H. in Public Health

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Health Policy and Administration with the M.P.H. in Public Health offered at the following campuses:

Undergraduate Degree

- Beaver
- Harrisburg
- Hazleton
- Lehigh Valley
- Mont Alto
- Shenango
- University Park
- World Campus

Graduate Degree

- Hershey
- World Campus

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students must apply to and meet the admissions requirements of the Graduate School, as well as the graduate program in which they intend to receive their master's degree. Admission to the IUG and the M.P.H. degree program is granted jointly by the M.P.H. Program and the Graduate School at Penn State. The requirements presented here are in addition to the Graduate School's requirements for admission. To be eligible to apply to the IUG program, applicants must meet the following requirements:

Requirements	Guidelines
GPA	<ul style="list-style-type: none"> • Cumulative GPA: 3.25 or greater • GPA in HPA major courses: 3.0 or greater
Education	<ul style="list-style-type: none"> • Enrollment in the B.S. in HPA degree program • Completion of the following courses: HPA 101, HPA 311, STAT 200 or STAT 250

The M.P.H. in Public Health program will continue to monitor the academic performance of the undergraduate students who apply and are admitted to the IUG program. If students fall below the GPA requirements during the undergraduate portion of the IUG plan of study, they may be put on probation or terminated from the IUG program altogether.

IUG application requirements include the following:

- Completed online Penn State Graduate School application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) with nonrefundable application fee
- Resume or curriculum vitae
- Statement of purpose
- Two letters of recommendation, including one from the student's undergraduate academic adviser that proves the academic adviser has worked with the student to develop a draft IUG plan of study
- Official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>)
- Preliminary draft plan of study. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.

Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. Students can be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree.

Degree Requirements

B.S./M.P.H. degree requirements are the same as that of the standalone M.P.H. degree program. Students must fulfill all degree requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Science in Health Policy and Administration are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). Degree requirements for the Master of Public Health degree are listed on the Degree Requirements tab.

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.P.H. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Up to 12 credits of M.P.H. degree course work will double count towards the B.S. in Health Policy and Administration degree requirements. A minimum of 50% of the double-counted credits must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
PHS/BBH 504	Behavioral Health Intervention Strategies	3
PHS 520	Principles of Biostatistics	3
or STAT 500	Applied Statistics	
One of the following:		
PHS 550	Principles of Epidemiology	
HPA 540	Epidemiological Applications in Health Services Research	
STAT 507	Epidemiologic Research Methods	
PHS 571	Health Services Organization and Delivery	3
or HPA 520	The U.S. Health Care Industry and Health Services Organizations	

Advising of Students

The M.P.H. in Public Health program will assign IUG students with an academic adviser. This adviser is in addition to the one assigned to them as undergraduate students enrolled in the B.S. in HPA degree program. The M.P.H. in Public Health adviser will be a faculty member from the Department of Public Health Sciences at the Penn State College of Medicine in Hershey, PA who is a member of the Graduate Faculty. The academic adviser will be assigned upon entry into the M.P.H. degree program. If advisers are on different campuses than their respective students, they will communicate with their students through a combination of videoconferencing (via Skype or other mechanism), phone, email, and in person meetings.

INTEGRATED B.S. IN KINESIOLOGY AND M.P.H. IN PUBLIC HEALTH

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Kinesiology with the M.P.H. in Public Health offered at the following campuses:

Undergraduate Degree

- Altoona
- Berks
- Harrisburg
- University Park

Graduate Degree

- Hershey
- World Campus

ADMISSION REQUIREMENTS

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students must apply to and meet the admissions requirements of the Graduate School, as well as the graduate program in which they intend to receive their master's degree. Admission to the IUG and the M.P.H. degree program is granted jointly by the M.P.H. Program and the Graduate School at Penn State. The requirements presented here are in addition to the Graduate School's requirements for admission. To be eligible to apply to the IUG program, applicants must meet the following requirements:

Requirements

GPA

Guidelines

- Cumulative GPA: 3.3 or greater
- GPA in Kinesiology major courses: 3.0 or greater

Education

- Enrollment in the B.S. in Kinesiology degree program
- Completion of the following courses:
 - BIOL 110, CHEM 110, KINES 100, KINES 101
 - Three of the following six courses: KINES 321, KINES 341, KINES 345, KINES 350, KINES 360, KINES 384
 - STAT 200, STAT 250, or SCM 200

The M.P.H. in Public Health program will continue to monitor the academic performance of the undergraduate students who apply and are admitted to the IUG program. If students fall below the GPA requirements during the undergraduate portion of the IUG plan of study, they may be put on probation or terminated from the IUG program altogether.

IUG application requirements include the following:

- Completed online Penn State Graduate School application (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>) with nonrefundable application fee
- Resume or curriculum vitae
- Statement of purpose
- Two letters of recommendation, including one from the student's undergraduate academic adviser that proves the academic adviser has worked with the student to develop a draft IUG plan of study

- Official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>)
- Preliminary draft plan of study. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.

Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. Students can be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree.

DEGREE REQUIREMENTS

B.S./M.P.H. degree requirements are the same as that of the standalone M.P.H. degree program. Students must fulfill all degree requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Science in Health Policy and Administration are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). Degree requirements for the Master of Public Health degree are listed on the Degree Requirements tab.

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.P.H. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Up to 15 credits of M.P.H. degree course work will double count towards the B.S. in Kinesiology degree requirements. A minimum of 50% of the double-counted credits must be at the 500 or 800 level. Students can complete all 15 double-counted credits with PHS courses or they may choose to take KINES courses to meet their track elective requirements. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
PHS 504	Behavioral Health Intervention Strategies	3
PHS 520	Principles of Biostatistics	3
PHS 550	Principles of Epidemiology	3
PHS 571	Health Services Organization and Delivery	3
PHS 809	Principles of Public Health	3
KINES 421	Exercise Psychology	3
KINES 422	Physical Activity Interventions	3
KINES 424	Women and Sport	3
KINES 425W	Physical Activity in Diverse Populations	3
KINES 426	Physical Activity and Public Health	3
KINES 429	Psychology of Sport Performance	3
KINES 445	Alcohol and Drug Education	3
KINES 454	Women's Health and Exercise Across the Lifespan	3

KINES 455	Physiological Basis of Exercise as Medicine	3
KINES 457	Exercise Prescription and Case Studies	3
KINES 459	Community Engagement and Outreach in Kinesiology	3
KINES 481W	Scientific Basis of Exercise for Older Adults	3
KINES 499	Foreign Studies	3
KINES 530	Experimental Design and Methodology in Kinesiology	3
KINES 588	Scientific Writing in Kinesiology	3

ADVISING OF STUDENTS

The M.P.H. in Public Health program will assign IUG students with an academic adviser. This adviser is in addition to the one assigned to them as undergraduate students enrolled in the B.S. in Kinesiology degree program. The M.P.H. in Public Health adviser will be a faculty member from the Department of Public Health Sciences at the Penn State College of Medicine in Hershey, PA who is a member of the Graduate Faculty. The academic adviser will be assigned upon entry into the M.P.H. degree program. If advisers are on different campuses than their respective students, they will communicate with their students through a combination of videoconferencing (via Skype or other mechanism), phone, email, and in person meetings.

INTEGRATED B.S. IN NUTRITIONAL SCIENCES AND M.P.H. IN PUBLIC HEALTH

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Nutritional Sciences with the M.P.H. in Public Health offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- Hershey
- World Campus

ADMISSION REQUIREMENTS

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students must apply to and meet the admissions requirements of the Graduate School, as well as the graduate program in which they intend to receive their master's degree. Admission to the IUG and the M.P.H. degree program is granted jointly by the M.P.H. Program and the Graduate School at Penn State. The requirements presented here are in addition to the Graduate School's requirements for admission. To be eligible to apply to the IUG program, applicants must meet the following requirements:

Requirements	Guidelines
GPA	<ul style="list-style-type: none"> Cumulative GPA: 3.25 or greater GPA in Nutritional Sciences major courses: 3.0 or greater
Education	<ul style="list-style-type: none"> Enrollment in the B.S. in Nutritional Sciences degree program Completion of the following courses: BIOL 161, CHEM 110, NUTR 361, STAT 200 or STAT 250.

The M.P.H. in Public Health program will continue to monitor the academic performance of the undergraduate students who apply and are admitted to the IUG program. If students fall below the GPA requirements during the undergraduate portion of the IUG plan of study, they may be put on probation or terminated from the IUG program altogether.

IUG application requirements include the following:

- Completed online Penn State Graduate School application (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>) with nonrefundable application fee
- Resume or curriculum vitae
- Statement of purpose
- Two letters of recommendation, including one from the student's undergraduate academic adviser that proves the academic adviser has worked with the student to develop a draft IUG plan of study
- Official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>)
- Preliminary draft plan of study. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.

Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. Students can be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree.

DEGREE REQUIREMENTS

B.S./M.P.H. degree requirements are the same as that of the standalone M.P.H. degree program. Students must fulfill all degree requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Science in Nutritional Sciences are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). Degree requirements for the Master of Public Health degree are listed on the Degree Requirements tab.

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next

appropriate Commencement. If students accepted into the IUG program are unable to complete the M.P.H. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Up to 15 credits of M.P.H. degree course work will double count towards the B.S. in Nutritional Sciences degree requirements. A minimum of 50% of the double-counted credits must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
COURSE ELIGIBLE TO DOUBLE COUNT FOR BOTH DEGREES		
PHS 504	Behavioral Health Intervention Strategies	3
PHS 520	Principles of Biostatistics	3
PHS 550	Principles of Epidemiology	3
PHS 571	Health Services Organization and Delivery	3
PHS 809	Principles of Public Health	3
<i>STUDENTS MAY CHOOSE TO COMPLETE ALL 15 DOUBLE-COUNTED CREDITS WITH THE PHS COURSES IDENTIFIED ABOVE. ALTERNATIVELY, UP TO SIX CREDITS OF NUTRITIONAL SCIENCES COURSES CAN BE DOUBLE-COUNTED FOR M.P.H. ELECTIVES. FOLLOWING IS A LIST OF NUTRITIONAL SCIENCES COURSES THAT CAN BE APPLIED TO THE B.S. AND M.P.H. DEGREES:¹</i>		
NUTR 425	Global Nutrition Problems: Health, Science, and Ethics	3
NUTR 511	Maternal and Child Nutrition	3
NUTR 583	Nutritional Epidemiology	3

¹ If six credits of NUTR courses are counted toward the M.P.H. degree, only nine credits of PHS courses can be double-counted for both degrees.

Joint Degrees

Joint J.D./M.P.H. with Dickinson Law

Requirements listed here are in addition to requirements listed in GCAC-211 Joint Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-211-joint-degree-programs/>).

The M.P.H. in Public Health program and J.D. Program at Dickinson Law offer a joint degree program leading to the degrees of Juris Doctor (J.D.) and Master of Public Health (M.P.H.).

Admission Requirements

Admissions requirements for the J.D./M.P.H. program are the same as those for the J.D. and M.P.H. in Public Health programs. J.D./M.P.H. students will have to meet the admissions requirements of both programs, and each program will make a separate admissions decision. Admissions requirements and applications for admission for Dickinson Law are listed in the J.D. Admissions (<https://dickinsonlaw.psu.edu/admissions-aid/>) section of the Dickinson Law website. The admission requirements for the Master of Public Health are listed on the Admission Requirements tab. Students will first apply and be accepted to the J.D. program at the Dickinson Law. After being accepted to and matriculating at the Dickinson Law, J.D. students will be eligible to submit a Penn State Graduate Application for Admission to the M.P.H. in Public Health. J.D. students may submit an application starting their first semester in the J.D. program up through the fourth semesters of law school.

J.D./M.P.H. students who, for whatever reason, withdraw from the J.D. program retain the option of remaining in the M.P.H. in Public Health program to earn the graduate degree.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the J.D. program are listed on the Dickinson Law website (<https://dickinsonlaw.psu.edu/academics/curriculum/jd-program/>). Degree requirements for the M.P.H. degree are listed on the Degree Requirements tab.

Double-Counting of Courses

Twelve credits of J.D. course work may be double-counted toward the M.P.H. degree. In lieu of PHS 895A, J.D./M.P.H. students will complete IHCLN 997, which will double-count for both degrees. In addition, up to 9 law school elective credits will be double-counted towards the M.P.H.

Up to 9 credits of M.P.H. course work may be applied towards the J.D. degree. The Associate Dean for Academic Affairs at Dickinson Law will approve, in advance of the student's enrollment in M.P.H. elective courses, which of those courses will double-count towards to J.D. degree.

Advising of Students

All students in the J.D./M.P.H. program will have two academic advisers, one in the M.P.H. degree program and one in the J.D. program.

JOINT J.D./M.P.H. WITH PENN STATE LAW

Requirements listed here are in addition to requirements listed in GCAC-211 Joint Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-211-joint-degree-programs/>).

The M.P.H. in Public Health program and J.D. Program at Penn State Law offer a joint degree program leading to the degrees of Juris Doctor (J.D.) and Master of Public Health (M.P.H.).

ADMISSION REQUIREMENTS

Admissions requirements for the J.D./M.P.H. program are the same as those for the J.D. and M.P.H. in Public Health programs. J.D./M.P.H. students will have to meet the admissions requirements of both programs, and each program will make a separate admissions decision. Admissions requirements and applications for admission for Penn State Law are listed in the J.D. Application Requirements (<https://pennstatelaw.psu.edu/admissions/jd-admissions/application-requirements/>) section of the Penn State Law website. The admission requirements for the Master of Public Health are listed on the Admission Requirements tab. Students will first apply and be accepted to the J.D. program at Penn State Law. After being accepted to and matriculating at Penn State Law, J.D. students will be eligible to submit a Penn State Graduate Application for Admission (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>) to the M.P.H. in Public Health. J.D. students may submit an application starting their first semester in the J.D. program up through the fourth semester of law school.

J.D./M.P.H. students who, for whatever reason, withdraw from the J.D. program retain the option of remaining in the M.P.H. in Public Health program to earn the graduate degree.

DEGREE REQUIREMENTS

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the J.D. program (<https://pennstatelaw.psu.edu/academics/jd-program/>) are listed on the Penn

State Law website. Degree requirements for the M.P.H. degree are listed on the Degree Requirements tab.

DOUBLE-COUNTING OF COURSES

Twelve credits of J.D. course work may be double-counted toward the M.P.H. degree. In lieu of PHS 895A, J.D./M.P.H. students will complete a 900-level legal clinic or externship, which will double-count for both degrees. In addition, up to 9 law school elective credits will be double-counted towards the M.P.H.

Up to 12 credits of M.P.H. course work may be applied towards the J.D. degree. The Associate Dean for Academic Affairs at Penn State Law will approve, in advance of the student's enrollment in M.P.H. elective courses, which of those courses will double-count towards to J.D. degree.

ADVISING OF STUDENTS

All students in the J.D./M.P.H. program will have two academic advisers, one in the M.P.H. degree program and one in the J.D. program.

Joint J.D./Dr.P.H. with Dickinson Law

Requirements listed here are in addition to requirements listed in GCAC-211 Joint Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-211-joint-degree-programs/>).

The Dr.P.H. in Public Health program and J.D. Program at Penn State Dickinson Law offer a joint degree program leading to the degrees of Juris Doctor (J.D.) and Doctor of Public Health (Dr.P.H.).

Admission Requirements

Admissions requirements for the J.D./Dr.P.H. program are the same as those for the J.D. and Dr.P.H. in Public Health programs. J.D./Dr.P.H. students will have to meet the admissions requirements of both programs, and each program will make a separate admissions decision. Admissions requirements and applications for admission for Dickinson Law are listed in the J.D. Admissions section of the Dickinson Law website (<https://dickinsonlaw.psu.edu/jd-admissions/>). The admission requirements for the Doctor of Public Health are listed on the Admission Requirements tab. Students will first apply and be accepted to the J.D. program at the Penn State Dickinson Law. After being accepted to and matriculating at the Penn State Dickinson Law, J.D. students will be eligible to submit a Penn State Graduate Application for Admission to the Dr.P.H. in Public Health. J.D. students may submit an application starting their first semester in the J.D. program up through the fourth semesters of law school. J.D. students can submit LSAT scores in lieu of GRE scores if they can provide evidence to show quantitative skills (B or above for graduate level statistical/math courses or other standard test consisting of quantitative evaluation).

J.D./Dr.P.H. students who, for whatever reason, withdraw from the J.D. program retain the option of remaining in the Dr.P.H. in Public Health program to earn the graduate degree.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the J.D. program are listed on the Penn State Dickinson Law website (<https://dickinsonlaw.psu.edu/jd-program/>). Degree requirements for the Dr.P.H. degree are listed on the Degree Requirements tab.

Double-Counting of Courses

Twenty-four credits of J.D. coursework may be double-counted toward the Dr.P.H. degree. In lieu of PHS 895B, J.D./Dr.P.H. students will complete IHCLN 997 Medical-Legal Partnership Clinic (3 cr.), which will double-

count for both degrees. In addition, up to 21 law school elective credits will be double-counted towards the Dr.P.H. The Associate Dean for Academic Affairs at Dickinson Law will approve, in advance of the student's enrollment in Dr.P.H. elective courses, which of those courses will double-count towards to J.D. degree.

Advising of Students

All students in the J.D./Dr.P.H. program will have two academic advisors, one in the Dr.P.H. degree program and one in the J.D. program.

Joint M.D./M.P.H. with the College of Medicine

Requirements listed here are in addition to requirements listed in GCAC-211 Joint Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-211-joint-degree-programs/>).

The M.P.H. in Public Health program and M.D. Program at Penn State Hershey College of Medicine offer a joint degree program leading to the degrees of Doctor of Medicine (M.D.) and Master of Public Health (M.P.H.).

Admission Requirements

Admissions requirements for the M.D./M.P.H. program are the same as those for the M.D. and M.P.H. in Public Health programs. M.D./M.P.H. students will have to meet the admissions requirements of both programs, and each program will make a separate admissions decision. The admission requirements for the M.P.H. degree are listed on the Admission Requirements tab. Admissions requirements and applications for admission for the Penn State College of Medicine are available at the M.D. Program (<http://med.psu.edu/md/>) section of the Penn State College of Medicine website. Students will first apply and be accepted to the M.D. program at the Penn State College of Medicine. After being accepted to and matriculating at the Penn State M.D. program, M.D. students will be eligible to submit a Penn State Graduate Application for Admission to the M.P.H. in Public Health. M.D. students may submit an application starting their first semester in the M.D. program up through the fall semester of their third year of medical school.

M.D./M.P.H. students who, for whatever reason, withdraw from the M.D. program retain the option of remaining in the M.P.H. in Public Health program to earn the graduate degree.

Degree Requirements

M.D./M.P.H. degree requirements are the same as that of the standalone M.P.H. degree program. Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the M.D. program are listed on the M.D. Program (<http://med.psu.edu/md/>) section of the Penn State College of Medicine website. Degree requirements for the M.P.H. degree are listed on the Degree Requirements tab.

Double-Counting of Courses

Sixteen credits of M.D. course work may be double-counted toward the M.P.H. degree.

Advising of Students

All students in the M.D./M.P.H. program will have two academic advisers, one in the M.P.H. degree program and one in the M.D. program.

Joint M.D./M.P.H. with Taipei Medical University

Requirements listed here are in addition to requirements listed in GCAC-211 Joint Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-211-joint-degree-programs/>).

The M.P.H. in Public Health program and T.M.U. offer a joint degree program leading to the degrees of Doctor of Medicine (M.D.) from T.M.U. and Master of Public Health (M.P.H.) from Penn State.

Admission Requirements

Admissions requirements for this program are the same as those for the T.M.U. M.D. and M.P.H. in Public Health programs. Students will have to meet the admissions requirements of both programs (T.M.U. and Penn State program), and each program will make a separate admissions decision. Admissions requirements for T.M.U. medical students are listed in the [Admissions \(https://oge.tmu.edu.tw/prospective-students/admission/\)](https://oge.tmu.edu.tw/prospective-students/admission/) section of the T.M.U. website. The admission requirements for the Master of Public Health are listed on the Admission Requirements tab. Students will first apply and be accepted to the M.D. or Pharm.D. program at T.M.U. After being accepted to and matriculating at T.M.U., M.D. and Pharm.D. students will be eligible to submit a Penn State Graduate Application for Admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) to the M.P.H. in Public Health. T.M.U. students may submit an application starting their first semester in the medical or pharmacy program up through their fourth year of school.

M.D./M.P.H. students who, for whatever reason, withdraw from the M.D. program retain the option of remaining in the M.P.H. in Public Health program to earn the graduate degree.

Degree Requirements

Degree requirements for T.M.U. students are the same as that of the standalone M.P.H. degree program including the completion of 42 credits. Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the transfer of credits as outlined below. Degree requirements for the M.P.H. degree are listed on the Degree Requirements tab. For degree requirements for the M.D., contact Taipei Medical University.

Transfer of Courses

Sixteen credits of course work completed at Taipei Medical University may be transferred toward the M.P.H. degree.

Advising of Students

All students in the M.D./M.P.H. program will have two advisers, one administrative adviser and one academic adviser in the M.P.H. degree program.

Joint Pharm.D./M.P.H. with Taipei Medical University

Requirements listed here are in addition to requirements listed in GCAC-211 Joint Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-211-joint-degree-programs/>).

The M.P.H. in Public Health program and T.M.U. offer a joint degree program leading to the degrees of Doctor of Pharmacy (Pharm.D.) from T.M.U. and M.P.H. from Penn State.

Admission Requirements

Admissions requirements for this program are the same as those for the T.M.U. Pharm.D. and M.P.H. in Public Health programs. Students will have to meet the admissions requirements of both programs (T.M.U. and Penn State program), and each program will make a separate admissions decision. Admissions requirements for T.M.U. pharmacy students are listed in the [Admissions \(https://oge.tmu.edu.tw/prospective-students/admission/\)](https://oge.tmu.edu.tw/prospective-students/admission/) section of the T.M.U. website. The admission requirements for the Master of Public Health are listed on the Admission Requirements tab. Students will first apply and be accepted to the Pharm.D. program at T.M.U. After being accepted to and matriculating at T.M.U., Pharm.D. students will be eligible to submit a Penn State Graduate Application

for Admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) to the M.P.H. in Public Health. T.M.U. students may submit an application starting their first semester in the medical or pharmacy program up through their fourth year of school.

Pharm.D./M.P.H. students who, for whatever reason, withdraw from the Pharm.D. program retain the option of remaining in the M.P.H. in Public Health program to earn the graduate degree.

Degree Requirements

Degree requirements for T.M.U. students are the same as that of the standalone M.P.H. degree program including the completion of 42 credits. Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the transfer of credits as outlined below. Degree requirements for the M.P.H. degree are listed on the Degree Requirements tab. For degree requirements for the M.D. or Pharm.D., contact Taipei Medical University.

Transfer of Courses

Sixteen credits of course work completed at Taipei Medical University may be transferred toward the M.P.H. degree.

Advising of Students

All students in the Pharm.D./M.P.H. program will have two advisers, one administrative adviser and one academic adviser in the M.P.H. degree program.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may

be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Public Health Sciences (PHS) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/phs/>)

Learning Outcomes

Master of Public Health (M.P.H.)

- Demonstrate meaningful scholarship through competencies that include evidence-based approaches to public health, public health & health care systems, planning and management to promote health, policy in public health, leadership, communication, interprofessional practice and systems thinking.
- Apply effective communication skills (oral and written) to diverse audiences and with an understanding of the importance of cultural competence.
- Apply knowledge and skills learned in the classroom to real-world public health issues.
- Synthesize and integrate knowledge acquired in course work and other learning experiences and apply it to analyzing and addressing a public health practice or research challenge.

Contact

Master of public hEalth (m.P.H.)

Graduate Program Head: Cheryl Thompson

Director of Graduate Studies/Professor-in-Charge: Wenke Hwang

Primary Program Contact: Shannon Tuininga

Email: smb611@psu.edu

Mailing Address: Dept of Public Health Sciences, A210, 90 Hope Dr, Suite 2200, Hershey, PA 17033

Telephone: (717) 531-7178

Program Website: Public Health (<http://med.psu.edu/publichealth/>)

Doctor of Public Health (Dr. P. H.)

Graduate Program Head: Cheryl Thompson

Director of Graduate Studies/Professor-in-Charge: Jessica Yingst

Primary Program Contact: Justine Shultz

Email: jes5437@psu.edu

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Public Policy

Graduate Program Head	Emily Vargo
Program Code	PPOL
Campus(es)	University Park (M.P.P.)
Degrees Conferred	Master of Public Policy (M.P.P.) Collaborative International-Concurrent Degree Program with the KDI School of Public Policy and Management Collaborative International-Concurrent Degree Program with Seoul National University Collaborative International-Concurrent Degree Program with Sungkyunkwan University Integrated B.A. in African American Studies and M.P.P. in Public Policy Integrated B.A./B.S. in Communication Arts and Sciences and M.P.P. in Public Policy Integrated B.S. in Criminology and M.P.P. in Public Policy Integrated B.S. in Health Policy and Administration and M.P.P. in Public Policy Integrated B.A. in Political Science and M.P.P. in Public Policy Integrated B.S. in Sociology and M.P.P. in Public Policy
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=facprog=PPOL)

The Master of Public Policy (M.P.P.) degree program is designed to provide professional training in public policy for those seeking careers in the design, adoption, implementation, and evaluation of public policies. The professional careers students should be prepared for include the full range of careers for which public policy expertise would be valued: national, state, and local government agencies, think tanks and consulting firms, non-profit organizations, and lobby firms and private sector organizations engaged in public affairs representation. The core of the M.P.P. degree curriculum will provide students with a strong knowledge base relevant to public policy rooted in the social science disciplines of economics, political science, sociology, and industrial psychology housed in the College of the Liberal Arts along with training in quantitative policy analysis and evaluation. And through its specialization course requirements, it will provide students with public policy relevant training across a wide spectrum of substantive public policy areas drawing on expertise found on the University Park campus. Students will work closely with faculty to design a specialization curriculum around their core course work.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

All applicants will submit a résumé or curriculum vitae, two letters of recommendation, and a personal statement addressing their reasons for pursuing a graduate degree in public policy and discussing their plans and goals.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

English proficiency test scores must meet or exceed the minimum acceptable scores listed in GCAC-305. Applicants with a score of 19 or higher on the speaking section of the TOEFL Internet-based test will be considered for admission, though a score of 23 or higher is desirable. The minimum IELTS score required for admission is 7.0 (overall, and in each of the subsections).

Admissions will be based on a review of all submitted materials and spaces will be offered to the best qualified applicants, taking into account academic achievement, relevant work experience and other indices of aptitude for advanced study in public policy.

Degree Requirements

Master of Public Policy (M.P.P.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

A minimum of 43 credits (42 credits for students with significant professional experience who may waive the internship requirement with approval of the M.P.P. program director) at the 400, 500, or 800 level, with at least 18 credits at the 500 or 800 level and a minimum of 6 credits at the 500 level, is required. More specifically, the program requires 18 credits in 6 core courses that are designed to establish a base of knowledge in key subject areas reflecting statistical skills, economic concepts, and policy making institutions. Students must also choose one bureaucracy/organization-focused course from PPOL 804, PPOL 805, or PPOL 807.

In addition to these degree requirements, students must complete one PPOL elective, a 1-credit internship and a capstone project as their master's culminating experience, PPOL 894, for 3 credits. The capstone project will involve completing an applied policy project showing mastery of the subject matter. Students with significant work experience may waive the 1 credit internship requirement with the approval of the M.P.P. program director and complete the degree with 42 rather than 43 credits.

Code	Title	Credits
Required Courses		
PPOL 503	Statistics for Public Policy I	3
PPOL 506	Statistics for Public Policy II	3
PPOL 801	The Public Policy Process	3
PPOL 802	Economic Analysis for Public Policy	3
PPOL 808	Public Finance and Budgeting	3
PPOL 809	Public Policy Analysis	3
PPOL 810	Policy and Program Evaluation	3
Must Choose One of the Following:		3
PPOL 804	Public Sector Organization Theory	

PPOL 805	Bureaucracy and the Policy Process	
PPOL 807	Managing Public Organizations	
<i>Electives</i>		3
Electives can be chosen from any course with a PPOL course abbreviation.		
<i>Specialization</i>		
An additional four courses (12 credits) are required in the student's field of public policy specialization. These courses will be selected by students with approval from the M.P.P. program and may be at the 400, 500, or 800 level. Students may count up to 12 credits in the fields of specialization from 400-level courses.		12
<i>Internship</i>		
PPOL 895	Public Policy Internship	1
The Internship requirement may be waived with approval of the M.P.P. program director.		
Culminating Experience		
PPOL 894	Capstone Experience (Capstone Project)	3
Total Credits		43

Collaborative International Programs

Collaborative International-Concurrent Degree Program with the KDI School of Public Policy and Management

Requirements listed here are in addition to requirements listed in GCAC 214 Collaborative Graduate Education Programs with Institutions Outside of the United States. (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-214-collaborative-graduate-education-programs-with-institutions-outside-of-the-united-states/>)

This Collaborative-International Concurrent Degree (CICD) Program is an opportunity for students in specified master's degree programs at KDI School of Public Policy and Management (<https://kdischool.ac.kr>) to complete the requirements for a master's degree at KDI School in one year and then complete the requirements for the M.P.P. degree at Penn State, completing two master's degree programs in two calendar years.

The eligible degree programs are: Master of Public Policy, Master of Public Management, Master of Development Policy and Master of Intellectual Property and Development. The M.P.P. at KDI is more focused on Korea, while PSU's curriculum is more focused on the U.S. All of these degree programs require the same, or very similar analytic skills, but cover somewhat different substantive areas, and are thus highly complementary.

The M.P.P. program at Penn State will accept 15 credits completed at KDI and KDI students will complete an additional 27 credits at Penn State.

ADMISSION REQUIREMENTS

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students will first apply and be admitted to KDI School using the normal KDI School application and admission process. In the fall semester of their first year, students will apply for admission to the M.P.P. program at Penn State.

Students must apply to the program via the Graduate School application for admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet all the admission requirements of the

apply/), and must meet all the admission requirements of the Graduate School and the Public Policy graduate program for the Master of Public Policy degree.

ADVISING

Students admitted to the program are advised by the M.P.P. program adviser on program-specific matters and staff in International Student and Scholar Advising (ISSA) (<https://global.psu.edu/article/student-support-and-success-international-student-advising/>) on matters generally affecting international students.

SEQUENCE OF COURSES

Students will complete all requirements toward the KDI master's degree in year one of the program, and complete all Penn State requirements in year two of the program.

PLAN OF STUDY

Upon admission to the program students will prepare a plan of study outlining the courses that they will take in their year at Penn State.

DEGREE REQUIREMENTS

Students must fulfill all requirements for each degree in order to be awarded that degree. Students who do not complete the Penn State degree may graduate with a master's degree from KDI School. Over 40 courses from KDI are eligible to double count for the Penn State M.P.P. Program.

Collaborative International-Concurrent Degree Program with the SEOUL National University Graduate School of Public Administration

Requirements listed here are in addition to requirements listed in GCAC 214 Collaborative Graduate Education Programs with Institutions Outside of the United States. (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-214-collaborative-graduate-education-programs-with-institutions-outside-of-the-united-states/>)

This Collaborative-International Concurrent Degree (CICD) Program is an opportunity for students in Global Master's of Public Administration (MP A) degree program at Seoul National University to complete the requirements for a master's degree at Seoul National University in one year and then complete the requirements for the M.P.P. degree at Penn State, completing two master's degree programs in two calendar years.

The M.P.P. program at Penn State will accept 15 credits completed at Seoul National University and Seoul National University students will complete an additional 27 credits at Penn State.

ADMISSION REQUIREMENTS

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students will first apply and be admitted to Seoul National University GSPA using the normal GSPA application and admission process. In the fall semester of their first year, students will apply for admission to the M.P.P. program at Penn State.

Students must apply to the program via the Graduate School application for admission (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet all the admission requirements of the

Graduate School and the Public Policy graduate program for the Master of Public Policy degree.

ADVISING

Students admitted to the program are advised by the M.P.P. program adviser on program-specific matters and staff in International Student and Scholar Advising (ISSA) (<https://global.psu.edu/article/student-support-and-success-international-student-advising/>) on matters generally affecting international students.

SEQUENCE OF COURSES

Students will complete all requirements toward the Seoul National University master's degree in year one of the program, and complete all Penn State requirements in year two of the program.

PLAN OF STUDY

Upon admission to the program students will prepare a plan of study outlining the courses that they will take in their year at Penn State.

DEGREE REQUIREMENTS

Students must fulfill all requirements for each degree in order to be awarded that degree. Students who do not complete the Penn State degree may graduate with a master's degree from Seoul National University. Over 20 courses from Seoul National University are eligible to double count for the Penn State M.P.P. Program.

Collaborative International-Concurrent Degree Program with Sungkyunkwan University

Requirements listed here are in addition to requirements listed in GCAC 214 Collaborative Graduate Education Programs with Institutions Outside of the United States. (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-214-collaborative-graduate-education-programs-with-institutions-outside-of-the-united-states/>)

This Collaborative-International Concurrent Degree (CICD) Program is an opportunity for students in the Master of Public Administration at Sungkyunkwan University (SKKU) (<https://www.skku.edu/eng/>) to complete the requirements for a master's degree at SKKU in one year and then complete the requirements for the M.P.P. degree at Penn State, completing two master's degree programs in two calendar years.

The M.P.P. program at Penn State will accept 15 credits completed at SKKU and SKKU students will complete an additional 27 credits at Penn State.

ADMISSION REQUIREMENTS

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students will first apply and be admitted to the SKKU M.P.A. program using the normal SKKU Graduate School of Governance application and admission process. In the fall semester of their first year, students will apply for admission to the M.P.P. program at Penn State.

Students must apply to the program via the Graduate School application for admission (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet all the admission requirements of the Graduate School and the Public Policy graduate program for the Master of Public Policy degree.

ADVISING

Students admitted to the program are advised by the M.P.P. program adviser on program-specific matters and staff in International Student and Scholar Advising (ISSA) (<https://global.psu.edu/article/student-support-and-success-international-student-advising/>) on matters generally affecting international students.

SEQUENCE OF COURSES

Students will complete all requirements toward the SKKU Master's degree in year one of the program, and complete all Penn State requirements in year two of the program.

PLAN OF STUDY

Upon admission to the program students will prepare a plan of study outlining the courses that they will take in their year at Penn State.

DEGREE REQUIREMENTS

Students must fulfill all requirements for each degree in order to be awarded that degree. Students who do not complete the Penn State degree may graduate with a master's degree from SKKU. More than 80 courses from SKKU are eligible to double count for the Penn State M.P.P. Program.

Integrated Undergrad-Grad Programs INTEGRATED B.A. IN AFRICAN AMERICAN STUDIES AND M.P.P. IN PUBLIC POLICY

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

This Integrated Undergraduate/Graduate program (IUG) provides an opportunity for academically strong students to complete a bachelor of arts degree in African American Studies and a master's degree in Public Policy in the course of approximately five years of study. The Public Policy curriculum and African American Studies curriculum complement one another because an understanding of race and the African American experience is essential to understand U.S. public policy.

Students in the M.P.P. are required to complete an elective specialization of four courses. Students in the African American Studies-M.P.P. IUG will take their specialization in African American studies. They can either take four 400 and 500 level African American studies courses in their fourth year of study that will double count for both the B.A. and M.P.P.

At least two of these will be at the 500 level. Or, students can take two 400 and 500 level African American Studies courses toward the specialization and two M.P.P. course toward the Social Sciences and Community Development area of concentration in the BA degree in the fourth year and complete specialization courses in the fifth year of study. The students' IUG specific program of study will be structured on an individual basis giving IUG students a range of program options from the menu of course selections summarized below.

ADMISSION REQUIREMENTS

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Qualified students can apply formally during the semester in which they will complete 60 credits, typically the spring semester of their sophomore

year. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. It is recommended that students apply for admission to the IUG program before completing 90 credits, or in the last semester of their junior year, but consistent with general IUG guidelines, students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree.

Admission is selective based on criteria established by the leadership of the Public Policy program and Communication Arts and Sciences program. Though exceptions are possible, student applicants will generally have a minimum overall GPA of 3.2 in their major, and a minimum 3.2 GPA overall at the time of application (on a 4.0 scale). Students are admitted to the IUG based on good progress in their major, success in statistics and data analysis courses (evidenced by minimum 3.0 GPA in any undergraduate data analysis and statistics courses), faculty recommendations (two letters), GPA, and a 2-page statement of purpose explaining why they want to participate in this program and why they are qualified to do so. Students must apply to the program via the Graduate School application for admission, and must meet all the admission requirements of the Graduate School and the Public Policy graduate program for the Master of Public Policy degree.

In consultation with an adviser, students must prepare a plan of study appropriate to this integrated program, and must present their plan of study to the head of the graduate program or the appropriate committee overseeing the integrated program prior to being admitted to the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.

ADVISING

Students admitted to the program are advised by co-advisers, one from each participating unit. Each student will have a primary adviser in Public Policy who will work with the student and the co-adviser in Communication Arts and Sciences to ensure successful completion of the degree. The co-advisers will help the student prepare the initial plan of study, and assist in making changes and approving the student's plan of study each semester during the advising period.

SEQUENCE OF COURSES

During the first three years of study students will follow the basic course sequence provided for by the existing B.A plan in African American Studies. In the fourth year of study students can either take four 400 and 500 level African American studies courses that will double count for both the B.A. and M.P.P. At least two of these will be at the 500 level. Or, students can take two 400 and 500 level African American Studies courses toward the specialization and two 500 or 800 level M.P.P. courses toward the Social Sciences and Community Development area of concentration in the BA degree in the fourth year and complete specialization courses in the fifth year of study. Students who wish to graduate in 5 years will also take additional M.P.P. courses in their fourth year beyond this two, but these credits will count only toward the M.P.P. degree.

PLAN OF STUDY

Prior to admission to the program, and in consultation with their Communication Arts and Sciences and Public Policy advisers, students must prepare a detailed plan of study for years 4 and 5 of the program. The plan is periodically reviewed by the student and advisers, and revised as necessary. Most students will complete all requirements for the B.A.

and complete some graduate level M.P.P. requirements in the first four years, and take only M.P.P. courses in year 5.

DEGREE REQUIREMENTS

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.A. in African American Studies are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.P.P. degree are listed on the Degree Requirements tab. Up to 15 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted. The courses that are eligible to double count for both degrees are:

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
AFAM 409	Racial and Ethnic Inequality in America	3
AFAM 416	Race, Gender and Science	3
AFAM 422	Contemporary African American Communication	3
AFAM 431	Black Liberation and American Foreign Policy	3
AFAM 432	Between Nation and Empire: The Caribbean in the 20th Century	3
AFAM 460	African American Philosophy	3
AFAM 465	The Post-World War II Civil Rights Movement	3
AFAM 502	Blacks and African Diaspora	3
AFAM 503	Sexual and Gender Politics in the African Diaspora	3
AFAM 597	Special Topics	1-9

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count towards the graduate degree. Students must complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.P.P. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Integrated B.A./B.S. in Communication Arts and Sciences and M.P.P. in Public Policy

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

This Integrated Undergraduate/Graduate program (IUG) provides an opportunity for academically strong students to complete a bachelor of arts or bachelor of science degree in Communication Arts and Sciences and a master's degree in Public Policy in the course of approximately five years of study. The Public Policy curriculum and Communication Arts and Sciences curriculum require similar analytic skills and provide complementary substantive knowledge – understanding communication and rhetoric helps students to understand how communication about

public policy shapes their acceptance and effectiveness, among other outcomes.

Students in the M.P.P. are required to complete an elective specialization of four courses. Students in the Communication Arts and Sciences-M.P.P. IUG will take four 400 and 500 level courses in their fourth year of study that will double count for both the B.A./B.S. and M.P.P. At least two of these will be at the 500 level. The students' IUG specific program of study will be structured on an individual basis giving IUG students a range of program options from the menu of course selections summarized below.

ADMISSION REQUIREMENTS

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. It is recommended that students apply for admission to the IUG program before completing 90 credits, or in the last semester of their junior year.

Admission is selective based on criteria established by the leadership of the Public Policy program and Communication Arts and Sciences program. Though exceptions are possible, student applicants will generally have a minimum overall GPA of 3.4 in their major, and a minimum 3.4 GPA overall at the time of application (on a 4.0 scale). Students are admitted to the IUG based on good progress in their major, success in statistics and data analysis courses (evidenced by minimum 3.0 GPA in undergraduate data analysis and statistics courses), faculty recommendations (two letters), GPA, and a 2-page statement of purpose explaining why they want to participate in this program and why they are qualified to do so. Students must apply to the program via the Graduate School application for admission, and must meet all the admission requirements of the Graduate School and the Public Policy graduate program for the Master of Public Policy degree.

In consultation with an adviser, students must prepare a plan of study appropriate to this integrated program, and must present their plan of study to the head of the graduate program or the appropriate committee overseeing the integrated program prior to being admitted to the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.

ADVISING

Students admitted to the program are advised by co-advisers, one from each participating unit. Each student will have a primary adviser in Public Policy who will work with the student and the co-adviser in Communication Arts and Sciences to ensure successful completion of the degree. The co-advisers will help the student prepare the initial plan of study, and assist in making changes and approving the student's plan of study each semester during the advising period.

SEQUENCE OF COURSES

During the first three years of study students will follow the basic course sequence provided for by the existing B.A./B.S. plan in Communication Arts and Sciences. In the fourth year of study B.A. students will take four

courses that will count both toward the B.A. and the master's in Public Policy four course specialization in policy communication. At least two of these courses will be at the 500 level. In the fourth year of study B.S. students will take two 400 level or 500 level CAS courses that will double count for both the CAS B.S. and M.P.P., specifically for 6 of the 12 credit policy specialization required in the M.P.P. program. Two of the required statistics courses in the M.P.P. degree program (PPOL 503 and PPOL 506) will count toward the 12 credit quantification requirement. Students who wish to graduate in 5 years will also take additional M.P.P. courses in their fourth year beyond this two, but these credits will count only toward the M.P.P. degree.

PLAN OF STUDY

Prior to admission to the program, and in consultation with their Communication Arts and Sciences and Public Policy advisers, students must prepare a detailed plan of study for years 4 and 5 of the program. The plan is periodically reviewed by the student and advisers, and revised as necessary. Most students will complete all requirements for the B.A./B.S. in Communication Arts and Sciences and complete some graduate level M.P.P. requirements in the first four years, and take only M.P.P. courses in year 5.

DEGREE REQUIREMENTS

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.A./B.S. in Communication Arts and Sciences are listed in the Undergraduate Bulletin. Degree requirements for the M.P.P. degree are listed on the Degree Requirements tab. Up to 15 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted. The courses that are eligible to double count for both degrees are:

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
CAS 404	Conflict Resolution and Negotiation	3
CAS 406	Honors Course in Communication Arts and Sciences	3
CAS 409	Democratic Deliberation	3
CAS 426W	Communication Ethics	3
CAS 452W	Organizational Communication Theory and Research	3
CAS 453	Health Communication Theory and Research	3
CAS 471	Intercultural Communication Theory and Research	3
CAS 475	Studies in Public Address	3
CAS 478	Contemporary U.S. Political Rhetoric	3
CAS 509	Democratic Deliberation	3
CAS 550	Social Influence	3
CAS 561	Quantitative Research Methods	3
CAS 597	Special Topics	1-9

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next

appropriate Commencement. If students accepted into the IUG program are unable to complete the M.P.P. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Integrated B.S. in Criminology and M.P.P. In Public Policy

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

This Integrated Undergraduate/Graduate program (IUG) provides an opportunity for academically strong students to complete a bachelor of science degree in Criminology and a master's degree in Public Policy in the course of approximately five years of study. The Public Policy curriculum and Criminology curriculum cover require similar technical and analytic skills and provide complementary substantive knowledge – criminal justice is an important area of policy making from a public policy standpoint and it is critical to understand the policy process to understand the structure and impacts of criminal justice policies.

Students in the M.P.P. are required to complete an elective specialization of four courses. Students in the Criminology-M.P.P. IUG will take two 400 and two 500 level courses in their fourth year of study that will double count for both the Criminology B.S. and M.P.P. The students' IUG specific program of study will be structured on an individual basis giving IUG students a range of program options from the menu of course selections summarized below.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. Students will generally apply in their junior year. It is recommended that students apply for admission to the IUG program before completing 90 credits, or in the last semester of their junior year.

Admission is selective based on criteria established by the leadership of the Public Policy program and Criminology program. Though exceptions are possible, student applicants will generally have a minimum overall GPA of 3.4 in their major, and a minimum 3.4 GPA overall at the time of application (on a 4.0 scale). Students are admitted to the IUG based on good progress in their major, success in statistics and data analysis courses (evidenced by minimum 3.0 GPA in undergraduate data analysis and statistics courses), faculty recommendations (two letters), GPA, and a 2-page statement of purpose explaining why they want to participate in this program and why they are qualified to do so. Students must apply to the program via the Graduate School application for admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet all the admission requirements of the Graduate School and the Public

Policy graduate program for the Master of Public Policy degree. GRE scores are not required for IUG applicants.

In consultation with an adviser, students must prepare a plan of study appropriate to this integrated program, and must present their plan of study to the head of the graduate program or the appropriate committee overseeing the integrated program prior to being admitted to the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.

Advising

Students admitted to the program are advised by co-advisers, one from each participating unit. Each student will have a primary adviser in Public Policy who will work with the student and the co-adviser in Criminology to ensure successful completion of the degree. The co-advisers will help the student prepare the initial plan of study, and assist in making changes and approving the student's plan of study each semester during the advising period.

Sequence of Courses

During the first three years of study students will follow the basic course sequence provided for by the existing B.S. plan in Criminology. In the fourth year of study they will take four courses that will count both toward the B.S. in Criminology and the master's in Public Policy four course specialization in criminal justice policy. At least two of these courses will be at the 500 level. Students who wish to graduate in 5 years will also take additional M.P.P. courses in their fourth year beyond this two, but these credits will count only toward the M.P.P. degree.

Plan of Study

Prior to admission to the program, and in consultation with their Criminology and Public Policy advisers, students must prepare a detailed plan of study for years 4 and 5 of the program. The plan is periodically reviewed by the student and advisers, and revised as necessary. Most students will complete all requirements for the B.S. in Criminology and complete some graduate level M.P.P. requirements in the first four years, and take only M.P.P. courses in year 5.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.S. in Criminology are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.P.P. degree are listed on the Degree Requirements tab. Up to 15 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted. The courses that are eligible to double count for both degrees are:

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
CRIM 424	Drugs, Crime, and Society	3
CRIM 430	American Correctional System	3
CRIM 433	Sentencing	3
CRIM 435	Policing in America	3
CRIM 490	Crime Policy	3
CRIM 501	Criminal Justice Organizations and Institutions	3

CRIM 512	Criminological Theories	3
CRIM 597	Special Topics	1-9

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.P.P. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

INTEGRATED B.S. IN HEALTH POLICY AND ADMINISTRATION AND M.P.P. IN PUBLIC POLICY

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

This Integrated Undergraduate/Graduate program (IUG) provides an opportunity for academically strong students to complete a bachelor of science degree in Health Policy and Administration and a master's degree in public policy in the course of five years of study. The public policy curriculum and health policy and administration curriculum cover similar substantive topics and both fields require similar technical and analytic skills, so there is a natural synergy here.

6 credits (two classes) at the 400 or 500 level from the undergraduate B.S. requirements will be counted toward the M.P.P. program and 6 credits (two classes) at the 500 or 800 level from the M.P.P. program will be counted toward the health policy and administration B.S. "supporting courses" requirements. Student's IUG specific program of study will be structured on an individual basis giving IUG students a range of program options from the menu of course selections summarized below.

ADMISSION REQUIREMENTS

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students must apply to the program via the Graduate School application for admission (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet all the admission requirements of the Graduate School and the Public Policy graduate program for the Master of Public Policy degree. Though exceptions are possible, student applicants will generally have a minimum overall GPA of 3.2 in their major, and a minimum 3.2 GPA overall at the time of application (on a 4.0 scale). Students are admitted to the IUG based on good progress in their major, success in any statistics and data analysis courses taken (evidenced by minimum 3.0 GPA in undergraduate data analysis and statistics courses), faculty recommendations (including one letter from a political science faculty member), GPA, and a 2-page statement of purpose explaining why they want to participate in this program and why they are qualified to do so. Concurrent with application to the IUG program, students must also apply to, and be accepted into, the Graduate School at Penn State University.

Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. Students will generally apply to the IUG program in their junior year.

In consultation with an adviser, students must prepare a plan of study appropriate to this integrated program, and must present their plan of study to the head of the graduate program or the appropriate committee overseeing the integrated program prior to being admitted to the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.

ADVISING PROCEDURES

Students admitted to the program are advised by co-advisers, one from each participating unit. Each student will have a primary adviser in public policy who will work with the student and the co-adviser in health policy and administration to ensure successful completion of the degree. The co-advisers will help the student prepare the initial plan of study, and assist in making changes and approving the student's plan of study each semester during the advising period.

During the first three years of study students will follow the basic course sequence provided for by the existing B.S. plan in Health Policy and Administration. In the fourth year of study they will take two M.P.P. core courses at the 500 or 800 level that will count toward the B.S. in Health Policy and Administration (they will count toward the "supporting" courses requirement). Students who wish to graduate in 5 years will also take additional M.P.P. courses in their fourth year, beyond those that will double count toward the B.S. in Health Policy and Administration. In addition, in the fourth year two of the undergraduate 400 level courses taken as part of the B.S. will count toward M.P.P. program specialization electives.

DEGREE REQUIREMENTS

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.S. in Health Policy and Administration are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.P.P. degree are listed on the Degree Requirements tab. Up to 15 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
HPA 401	Comparative Health Systems	3
HPA 410	Principles of Public Health Administration	3
HPA 445	Health Economics	3
HPA 447	Financing Health Care	3
HPA 450	Healthcare Policies and Politics	3
HPA 506	Design and Evaluation of Prevention and Health Promotion Programs Across the Life Span	3
HPA 510	Health Services Financing and Policy	3
HPA 526	Health Disparities	3

HPA 527	Managing Healthcare Operations	3
HPA 528	Health Data Analysis for Research	3
HPA 541	Poverty, Race, Ethnicity and Child Health	3
HPA 545	Introduction to Health Economics	3

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.P.P. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Integrated B.A. in Political Science and M.P.P. In Public Policy

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

This Integrated Undergraduate/Graduate program (IUG) provides an opportunity for academically strong students to complete a bachelor of arts degree in political science and a master's degree in public policy in the course of five years of study. The public policy curriculum and political science curriculum cover similar substantive topics and both fields require similar technical and analytic skills, so there is a natural synergy here.

6 credits (two classes) at the 400 or 500 level from the undergraduate B.A. requirements will usually be counted toward the M.P.P. program and 6 credits (two classes) at the 500 or 800 level from the M.P.P. program will usually be counted toward the political science B.A. "supporting courses" requirements. Student's IUG specific program of study will be structured on an individual basis giving IUG students a range of program options from the menu of course selections summarized below.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students must apply to the program via the Graduate School application for admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet all the admission requirements of the Graduate School and the Public Policy graduate program for the Master of Public Policy degree. Though exceptions are possible, student applicants will generally have a minimum overall GPA of 3.5 in their major, and a minimum 3.5 GPA overall at the time of application (on a 4.0 scale). Students are admitted to the IUG based on good progress in their major, success in any statistics and data analysis courses taken (evidenced by minimum 3.0 GPA in undergraduate data analysis and statistics courses), faculty recommendations (including one letter from a political science faculty member), GPA, and a 2-page statement of purpose explaining why they want to participate in this program and why they are qualified to do so. Concurrent with application to the IUG program, students must

also apply to, and be accepted into, the Graduate School at Penn State University. GRE scores are not required for IUG applicants.

Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. Students will generally apply to the IUG program in their junior year. In order to ensure that students are properly advised during an advisement period students should apply by either November 1st of the fall of the junior year, or March 1st of the spring of the junior year.

In consultation with an adviser, students must prepare a plan of study appropriate to this integrated program, and must present their plan of study to the head of the graduate program or the appropriate committee overseeing the integrated program prior to being admitted to the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.

Advising Procedures

Students admitted to the program are advised by co-advisers, one from each participating unit. Each student will have a primary adviser in public policy who will work with the student and the co-adviser in political science to ensure successful completion of the degree. The co-advisers will help the student prepare the initial plan of study, and assist in making changes and approving the student's plan of study each semester during the advising period.

During the first three years of study students will follow the basic course sequence provided for by the existing B.A. plan in political science. In the fourth year of study they will take three M.P.P. core courses at the 500 or 800 level that will also count toward the B.A. in political science (they will count toward the "supporting" courses requirement). Students who wish to graduate in 5 years will also take additional M.P.P. courses in their fourth year, beyond those that will double count toward the B.A. in political science. In addition, in the fourth year one of the undergraduate 400 level courses taken as part of the B.A. will count toward M.P.P. program specialization electives.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.A. in Political Science are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.P.P. degree are listed on the Degree Requirements tab. Up to 15 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted. The courses that are eligible to double count for both degrees are:

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
PLSC 404	Analyzing Public Policy in the American States	3
PLSC 412	International Political Economy	3
PLSC 428	Gender and Politics	3
PLSC 429	Analysis of Electoral Politics	3

PLSC 438	National Security Policies	3
PLSC 439	The Politics of Terrorism	3
PLSC 440	Globalization and Its Implications	3
PLSC 503	Multivariate Analysis for Political Research	3
PLSC 504	Topics in Political Methodology	3
PLSC 505	Time Series Analysis in Political Science	3
PLSC 506	Game Theory for Political Science I	3
PLSC 551	Comparative Political Institutions	3

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.P.P. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Integrated B.S. in Sociology and M.P.P. in Public Policy

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

This Integrated Undergraduate/Graduate program (IUG) provides an opportunity for academically strong students to complete a bachelor of science degree in Sociology and a master's degree in Public Policy in the course of approximately five years of study. The Public Policy curriculum and Sociology curriculum cover similar technical and analytic skills and provide complementary substantive knowledge – social problems are an important focus of policy making and it is critical to understand the policy process to understand solutions to social problems.

Students in the M.P.P. are required to complete an elective specialization of four courses. Students in the Sociology-M.P.P. IUG will take four courses in their fourth year of study that will double count for both the Sociology B.S. and M.P.P. The students' IUG specific program of study will be structured on an individual basis giving IUG students a range of program options from the menu of course selections summarized below.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. It is recommended that students apply for admission to the IUG program before completing 90 credits, or in the last semester of their junior year.

Admission is selective based on criteria established by the leadership of the Public Policy program and Sociology program. Though exceptions

are possible, student applicants will generally have a minimum overall GPA of 3.4 in their major, and a minimum 3.4 GPA overall at the time of application (on a 4.0 scale). Students are admitted to the IUG based on good progress in their major, success in statistics and data analysis courses (evidenced by minimum 3.0 GPA in undergraduate data analysis and statistics courses), faculty recommendations (two letters), GPA, and a 2-page statement of purpose explaining why they want to participate in this program and why they are qualified to do so. Students must apply to the program via the Graduate School application for admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet all the admission requirements of the Graduate School and the Public Policy graduate program for the Master of Public Policy degree. GRE scores are not required for IUG applicants.

In consultation with an adviser, students must prepare a plan of study appropriate to this integrated program, and must present their plan of study to the head of the graduate program or the appropriate committee overseeing the integrated program prior to being admitted to the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.

Advising

Students admitted to the program are advised by co-advisers, one from each participating unit. Each student will have a primary adviser in Public Policy who will work with the student and the co-adviser in Sociology to ensure successful completion of the degree. The co-advisers will help the student prepare the initial plan of study, and assist in making changes and approving the student's plan of study each semester during the advising period.

Sequence of Courses

During the first three years of study students will follow the basic course sequence provided for by the existing B.S. plan in Sociology. In the fourth year of study they will take four courses that will count both toward the B.S. in Sociology and the master's in Public Policy. At least two of these courses will be at the 500 level. Specifically, 2 of the 400 level sociology courses will count toward the M.P.P. and 2 500-level M.P.P. courses will count toward the Sociology B.S. "other social science" credit requirements. Students who wish to graduate in 5 years will also take additional M.P.P. courses in their fourth year beyond this two, but these credits will count only toward the M.P.P. degree.

Plan of Study

Prior to admission to the program, and in consultation with their Sociology and Public Policy advisers, students must prepare a detailed plan of study for years 4 and 5 of the program. The plan is periodically reviewed by the student and advisers, and revised as necessary. Most students will complete all requirements for the B.S. in Sociology and complete some graduate level M.P.P. requirements in the first four years, and take only M.P.P. courses in year 5.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.S. in Sociology are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). Degree requirements for the M.P.P. degree are listed on the Degree Requirements tab. Up to 15 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-

counted. The Sociology courses that are eligible to double count for both degrees are:

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
SOC 400W	Senior Research Seminar	3
SOC 405	Sociological Theory	3
SOC 423	Social Demography	3
SOC 440	Family Policy	3
SOC 526	Health Disparities	3
SOC 532	Global Health and Mortality	3
SOC 530	Sociology of Family	3

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.P.P. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may

be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Public Policy Analysis (PPOL) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/ppol/>)

Learning Outcomes

- Students will be able to lead and manage in public organizations.
- Students will be able to participate in and contribute to the policy process.
- Students will be able to analyze, synthesize, think critically, solve problems and make decisions.
- Students will articulate and apply a public service perspective.
- Students will be able to communicate and interact productively with a diverse and changing workforce and citizenry.

Contact

Campus	University Park
Graduate Program Head	Emily Vargo
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Emily Vargo
Program Contact	Dustin S. Elder School of Public Policy Pond Lab University Park PA 16802 dse5029@psu.edu (814) 863-3950
Program Website	View (https://publicpolicy.psu.edu/)

Quality and Manufacturing Management

Graduate Program Head	Diane Parente
Program Code	QMM
Campus(es)	Erie (M.M.M.)
Degrees Conferred	Master of Manufacturing Management (M.M.M.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=QMM)

Penn State's Master of Manufacturing Management (M.M.M.) degree is offered by the Quality and Manufacturing Management (QMM) program. The degree is offered at Penn State Erie, The Behrend College, and is administered jointly by the School of Engineering and the Black School of Business. This interdisciplinary graduate program is designed to prepare students for careers in manufacturing, consulting, services, and operations. The program is offered in a full-time format and in a flexible scheduling pattern. Full-time study requires twelve months of continuous study starting in July and ending the following June. The flexible scheduling pattern requires approximately 24 months to complete.

Coursework is offered in a blended format of 75 percent online learning, one or two weekend campus visits per semester, and one three-day summer residency for plant visits.

The program develops future executives who possess in-depth, relevant manufacturing knowledge bridging engineering and management. Graduates are afforded a life-changing experience that provides them with a unique set of engineering, business, and quality skills combined with a suite of communication skills critical to management success. Students fuse Six Sigma certification with corporate social responsibility and emotional intelligence to become well-rounded leaders. QMM students develop business plans and analyze and predict corporate financial performance in a global marketplace. They emerge from Penn State as international leaders understanding the fundamentals of materials and processes and project confidence in product and manufacturing system design.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The program draws its students from two groups: practicing professionals from industry and individuals who have graduated from, or are currently enrolled in, a business administration, science, or engineering program. Applicants who expect to graduate with a baccalaureate in engineering, science, or business administration may apply for admission to the program in their senior year.

All applicants must have taken the prerequisite mathematics, computer science, and statistics courses or equivalents **prior to** starting the program. Applicants **cannot** register until they have completed these courses.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of Manufacturing Management (M.M.M.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The M.M.M. degree requires 32 credits of course work at the 400, 500, or 800 level, on a part- or full-time basis. The courses are as follows:

Code	Title	Credits
QMM 491	Introduction to Business Concepts for Manufacturing ¹	3
or QMM 492	Introduction to Engineering Design Principles	
QMM 552	Applied Statistical Process Control and Experimental Design	3
QMM 561	Manufacturing Systems Planning and Control I	3
QMM 562	Manufacturing Systems Planning and Control II	3
QMM 581	Manufacturing Processes of Materials	3

QMM 582	Manufacturing and Supply Chain Strategy	3
QMM 593	Field Experience in Manufacturing	2
QMM 851	Quality Management	3
QMM 871	Design Practice for Manufacturing I	3
QMM 872	Design Practice for Manufacturing II	3
QMM 891	Communication and Leadership Skills for Manufacturing Managers	3
Total Credits		32

¹ Both may be required depending on background of the applicant.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

A limited number of scholarships and graduate assistantships are available. Many students work full time and take classes part time. In many cases, employers have a tuition-reimbursement plan paying for partial or full tuition. View student aid options (<https://behrend.psu.edu/admissions-financial-aid/financial-aid/incoming-students/graduate/>) available.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Quality and Manufacturing Management (QMM) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/qmm/>)

Contact

Campus	Erie
Graduate Program Head	Diane Parente
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Yuan-Han Huang
Program Contact	Yuan-Han Huang School of Engineering 242 Burke Center Erie PA 16563 yhx25@psu.edu (814) 898-6942
Program Website	View (http://psbehrend.psu.edu/school-of-engineering/academic-programs/master-of-manufacturing-management/)

Real Estate Analysis and Development

Graduate Program Head	Brent W. Ambrose
Program Code	REA
Campus(es)	University Park (M.S.)
Degrees Conferred	Master of Science (M.S.) Master of Real Estate (M.R.E.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=facprog=REA)

The Master of Science in Real Estate Analysis and Development and the Master of Real Estate in Real Estate Analysis and Development will prepare graduates to stand out in a competitive job market by studying at a highly reputed business school with some of the world's leading real estate academic thinkers and industry experts. This program will provide students with the analytical skills grounded in economics and finance required to successfully engage in the real estate industry. Students will gain the skills needed to succeed in today's dynamic work environments, gain a firm understanding of issues and problems facing the real estate industry, develop an understanding and appreciation for leading edge research used to solve problems in real estate markets, and be prepared to become a successful leader. World-class professors who are specialists in real estate finance and economics will teach in the program. A solid foundation in decision analysis, project management, accounting, valuation, market analysis, econometrics, investment analysis and finance will make the target audience more attractive to hiring managers and enable graduates to advance more rapidly into management and leadership positions.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Educational Background

Applicants must:

- Submit a completed online Graduate School Application for Admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>), including short admissions essay, resume, and three professional references with complete contact information.
 - Résumé reflecting relevant professional experience including internships and co-op experiences.
- Submit official transcripts from all post-secondary institutions attended (<http://gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>).

Master of Real Estate (M.R.E.)

Students who do not have foundational backgrounds in statistics may be required to take MBADM 813 (or equivalent course work) prior to entering the program. The program faculty director will assess the background of each applicant.

Language of Instruction

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Core Application Packet

- Completed official online Graduate School application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) and payment of nonrefundable application fee.
- Statement of purpose: a 600-word essay articulating career and educational goals that demonstrates the applicant's written communication skills.
- Vita or Résumé.
- Two letters of recommendation that attest to the applicant's readiness for graduate study and document the requisite minimum of one year of work experience. Letters must be submitted through the online application.
- Official transcripts from all post-secondary institutions attended (<http://gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>).

Degree Requirements

Master of Real Estate (M.R.E.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The minimum total credits required for the REA_M program is 30 credits at the 400, 500, or 800 level, with a minimum of 18 credits at the 500 or 800 level, and at least 6 credits at the 500 level.

The culminating experience in the REA_M program consists of the creation and presentation of a real estate development proposal. Students will be presented with a potential development site during Module I in the fall term. Throughout the program, students will acquire the legal and institutional background and skills in data analysis and

financial and economic modelling required to propose a successful project that meets all stakeholder requirements. A committee of the graduate faculty in the real estate area in the Smeal College of Business will evaluate the project and presentation quality.

Code	Title	Credits
Required Courses		
BA 512	Quantitative Analysis for Managerial Decision Making	2
BA 817	Communication Skills for Management	2
BA 821	Foundation in Managerial Accounting	2
Elective courses can be chosen from a list of approved courses maintained by the graduate program office.		2-3
RM 424	Real Estate Law	3
REST 550	Contemporary Issues in Real Estate Markets	2
REST 570	Institutional Real Estate Investment	2
REST 575	Quantitative Analysis for Real Estate	3
REST 560	Real Estate Financial Analysis	2
REST 830	Real Estate Institutions and Markets Analysis	1
REST 840	Real Estate Analysis Software and Tools	1
REST 880	Real Estate Development and Analysis	2
REST 885	Real Estate and Business Valuation	3
REST 890	Colloquium	2
Culminating Experience		
REST 894	Capstone Experience	1
Total Credits		30-31

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The number of total credits required for the REA_MS program is 30 credits at the 400, 500, or 800 level, with at least 18 credits at the 500 level.

The culminating experience for the degree program will be an original scholarly paper that applies rigorous empirical methods to a selected topic related to real estate investments or securities. The culminating scholarly paper will build on and fully integrate content from courses in the REA_MS program. In particular, the REA_MS program contains 2-credits of a Real Estate Colloquium (REST 590) that will expose students to current research in real estate topics and thus require that they delve into the appropriate literature. Students in the REA_MS will be reminded on a regular basis of the research requirement and that they should be using the colloquium sessions to identify possible research topics. A committee of graduate faculty in the real estate area in the Smeal College of Business will evaluate the quality and completeness of the scholarly paper during Module IV in the Spring term.

Code	Title	Credits
Required Courses		
MBADM 811	Financial Accounting	3
STAT 500	Applied Statistics	3
BA 512	Quantitative Analysis for Managerial Decision Making	2
ECON 501	Econometrics	3
ECON 502	Microeconomic Analysis	3

REST 550	Contemporary Issues in Real Estate Markets	2
REST 560	Real Estate Financial Analysis	2
REST 570	Institutional Real Estate Investment	2
REST 575	Quantitative Analysis for Real Estate	3
REST 590	Colloquium (repeatable for a total of 2 credits)	2
REST 830	Real Estate Institutions and Markets Analysis	1
REST 840	Real Estate Analysis Software and Tools	1
REST 880	Real Estate Development and Analysis	2
Culminating Experience		
REST 594	Research Topics (Scholarly Paper)	1
Total Credits		30

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Real Estate (REST) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/rest/>)

Learning Outcomes

The Master of Science in Real Estate Analysis and Development and Master of Real Estate Analysis and Development Learning Goals and Objectives include:

1. Demonstrate Competency In and Across Real Estate Disciplines

REA_MS and REA_M graduates will master a broad core of financial and economic knowledge and be able to integrate and apply this knowledge to business situations within the real estate industry requiring interdisciplinary and global perspectives.

Learning Objectives:

- REA_MS and REA_M graduates will be able to demonstrate competency in the underlying concepts, theory, and tools taught in the REA_MS and REA_M curriculum.
- REA_MS and REA_M graduates will be able to use their knowledge of economics, finance, and real estate institutions and markets to identify, analyze, and recommend solutions to complex real estate problems and projects requiring interdisciplinary and global perspectives.
- REA_MS graduates will be capable of designing and implementing rigorous research methods to create new solutions to critical problems facing the real estate industry.

Assessment Method: Course-embedded measure (REST 560, REST 570, REST 575, and REST 590)

- REA_M graduates will be capable of designing and implementing a complex real estate development and market analysis plan based on applications of tools and techniques derived from rigorous economic and financial research.

Assessment Method: Course-embedded measure (REST 560, REST 570, and REST 880)

2. Analytical and Critical Thinking Skills

REA_MS and REA_M graduates will develop analytical and critical thinking skills needed to excel in today's business environment.

Learning Objectives:

- REA_MS and REA_M graduates will acquire the analytical and critical thinking skills needed to identify, analyze, and evaluate alternative solutions to problems and projects facing the real estate industry.
- REA_MS and REA_M graduates will develop the skills needed to craft and implement strategic and tactical plans.
- REA_MS and REA_M graduates will be able to articulate and defend their analysis and recommended solutions to multiple audiences from business, government, and the community.
- REA_MS and REA_M graduates will be able to integrate findings and analysis from cutting edge research to problems and projects in the real estate industry.

Assessment Method: Course-embedded measure (REST 570, REST 575, REST 880, REST 590, REST 890)

3. Interpersonal Skills

REA_MS and REA_M graduates will possess the interpersonal skills needed to be effective managers and leaders.

Learning Objectives:

- REA_MS and REA_M graduates will be skilled at leadership, team building, interpersonal influence, and the management of change.
- REA_MS and REA_M graduates will be able to communicate and work effectively with others in work settings involving cultural and demographic diversity.
- REA_MS and REA_M graduates will be competent at writing clear, concise, and analytical reports and documents.

Assessment Method: Course-embedded measure (REST 590, REST 880, BA 817)

4. Value System

REA_MS and REA_M graduates will be able to evaluate the ethical and societal implications of real estate investment and development decisions.

Learning Objectives:

- REA_MS and REA_M graduates will be skilled at evaluating the impact of various courses of action on multiple stakeholders, including investors, lenders, customers, and the broader community.

Assessment Method: Course-embedded measure (REST 830, REST 570, REST 880, REST 590, REST 890, BA 817)

Assessment Measures:

- **REA_MS:** The learning outcomes will be achieved by a combination of lectures by faculty and invited guest lecturers, reading of key literature, individual and team projects, and practical involvement in a research project. Course embedded measures will include an exam administered every Spring in REST 570, writing assignments embedded in REST 830, REST 590, REST 560, REST 570, REST 575, and REST 880, and a speaking assignment embedded every Spring in REST 594. A committee of graduate faculty in the real estate program will assess the students' research papers or essays in REST 594 to determine the students' ability to conduct a rigorous research project.
- **REA_M:** The learning outcomes will be achieved by a combination of lectures by faculty and invited guest lecturers, reading of key literature, individual and team projects, and practical involvement in a real estate development and market analysis culminating experience. Course embedded measures will include an exam administered every Spring in REST 570, writing assignments embedded in REST 830, REST 560, REST 570, REST 575, and REST 880, and a speaking assignment embedded every Spring in BA 817. Students will complete a culminating experience in REST 894 comprising the creation and presentation of a real estate development project. A committee of the graduate faculty in the real estate area in the Smeal College of Business will evaluate the project and presentation quality.

Contact

Campus	University Park
Graduate Program Head	Brent William Ambrose
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Brent William Ambrose
Program Contact	Andrea Lyn Murphy-Faust 220 Business Building University Park PA 16802 alm205@psu.edu (814) 863-0474
Program Website	View (https://msread.smeal.psu.edu/)

Recreation, Park, and Tourism Management

Graduate Program Head	Andrew Mowen
Program Code	RPTM
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Dual-Title Ph.D. and M.S. in Recreation, Park, and Tourism Management and Transdisciplinary Research on Environment and Society Dual-Title Ph.D. in Recreation, Park, and Tourism Management and Social Data Analytics
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=RPTM)

The graduate program is designed to prepare students for administrative, supervisory, research, and teaching positions in public and private recreation and park systems, in colleges and universities, in voluntary agencies and institutions, and in commercial ventures.

The program is oriented to meet the specific needs and research interests of the student. Students may pursue interests in the community, including public park and recreation systems, voluntary agencies, and private commercial enterprises; tourism; institution and community-oriented therapeutic settings concerned with many different disabilities and utilizing a variety of activity modalities; park planning, resource management, interpretive services, outdoor education, and outdoor recreation services.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Scores from the Graduate Record Examination (GRE) are NOT required for admission to the M.S. and Ph.D. programs.

For admission to the graduate program, an applicant must hold either (1) a bachelor's degree from a U.S. regionally accredited institution or (2) a postsecondary degree that is equivalent to a U.S. baccalaureate degree earned from an officially recognized degree-granting international institution. Applicants from majors other than recreation and parks are welcome to apply; however, additional course work is required. Students with a 3.00 junior/senior average (on a 4.00 scale) and with appropriate course backgrounds will be considered for admission.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The master's program is designed for students who wish to continue their studies at the doctoral level at Penn State.

The M.S. program requires a minimum of 30 graduate credits and a 3.00 (B) grade-point average for graduation. The master's degree must be completed within eight years from matriculation as a degree student.

Prerequisites for graduate students who do not have an undergraduate degree in RPTM typically range from 3 to 9 credits, depending on the student's background and experience. Prerequisites for incoming graduate students with undergraduate majors in RPTM range from 0 to 6 credits. Incoming graduate students with undergraduate degrees in Recreation, Park, and Tourism Management from Penn State are assumed to have met all prerequisite requirements. The graduate program director determines prerequisites for all incoming students.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A master's degree is required to apply to the Ph.D. program.

The doctoral program builds on the master's program to achieve depth in scholarship and research. Students who have not completed a data-based thesis as part of their master's degree will be required to do so during the first three semesters as a doctoral student. The general requirements of the degree, sequentially, are:

1. course work,
2. qualifying examination by the third semester,¹
3. comprehensive examination (written and oral),
4. dissertation proposal presentation, and
5. final defense of dissertation.

Between the qualifying examination and completion of the degree program, a Ph.D. student must have attended Penn State in residence a minimum of two semesters over a twelve-month period. (This may include the semester in which the qualifying exam is taken.) Students have a limit of eight years after the qualifying exam to complete the doctoral program. A 3.00 (B) average is required for graduation.

Prerequisites for graduate students who do not have an undergraduate degree in RPTM typically range from 3 to 9 credits, depending on the student's background and experience. Prerequisites for incoming graduate students with undergraduate majors in RPTM range from 0 to 6 credits. Incoming graduate students with undergraduate degrees in Recreation, Park, and Tourism Management from Penn State are assumed to have met all prerequisite requirements. The graduate program director determines prerequisites for all incoming students.

- 1 The master's thesis and oral defense may be used for the qualifying examination for continuing students.

Dual-Titles

Dual-Title M.S. and Ph.D. in Recreation, Park, and Tourism Management and TRANSDISCIPLINARY RESEARCH ON ENVIRONMENT AND SOCIETY

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://>)

gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/).

Admission Requirements

Students must apply and be admitted to the graduate program in Recreation, Park, and Tourism Management and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Transdisciplinary Research on Environment and Society dual-title program. Refer to the Admission Requirements section of the Transdisciplinary Research on Environment and Society Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/transdisciplinary-research-environment-society/>). Doctoral students should enroll in a dual-title graduate degree program early in their training, and no later than the end of the fourth semester (not counting summer semesters) of entry into the graduate major program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Recreation, Park, and Tourism Management. In addition, students must complete the degree requirements for the dual-title in Transdisciplinary Research on Environment and Society listed on the Transdisciplinary Research on Environment and Society Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/transdisciplinary-research-environment-society/>).

The qualifying examination in Recreation, Park, and Tourism Management satisfies the qualifying exam requirement for the dual-title degree program in Social Data Analytics.

In addition to the general Graduate Council requirements for Ph.D. committees, the Ph.D. committee of a Recreation, Park, and Tourism Management and Transdisciplinary Research on Environment and Society dual-title Ph.D. student must include at least one member of the Transdisciplinary Research on Environment and Society Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Transdisciplinary Research on Environment and Society, the member of the committee representing Transdisciplinary Research on Environment and Society must be appointed as co-chair. The Transdisciplinary Research on Environment and Society representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Recreation, Park, and Tourism Management and Transdisciplinary Research on Environment and Society. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

DUAL-TITLE PH.D. IN RECREATION, PARK, AND TOURISM MANAGEMENT AND SOCIAL DATA ANALYTICS

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-title-graduate-degree-programs/>).

gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-title-graduate-degree-programs/).

The doctoral students in Recreation, Park, and Tourism Management interested in having a degree that reflects interdisciplinary training in an array of tools, techniques, and methodologies for social data analytics, may apply to pursue a dual-title Ph.D. in Recreation, Park, and Tourism Management and Social Data Analytics.

Social data analytics is the integration of social scientific, computational, informational, statistical, and visual analytic approaches to the analysis of large or complex data that arise from human interaction. The dual-title Ph.D. program provides additional training with the aim of providing scientists with the skills required to expand the field of social data analytics, creatively answer important social scientific questions, and communicate effectively with both academic and non-academic audiences.

ADMISSION REQUIREMENTS

Students must apply and be admitted to the graduate program in Recreation, Park, and Tourism Management and the Graduate School before they can be admitted to a dual-title degree program. Applicants interested in the dual-title degree program may note their interest in their applications to Recreation, Park, and Tourism Management. Students admitted to the Recreation, Park, and Tourism Management program will be admitted to the dual-title program in Social Data Analytics upon the recommendation of a Social Data Analytics Program faculty member in Recreation, Park, and Tourism Management. Students must apply and be admitted to the dual-title degree program in Social Data Analytics prior to the completion of the fourth semester of graduate study.

Additional admissions requirements are listed in the Admissions Requirements section of the Social Data Analytics Bulletin page. (<https://bulletins.psu.edu/graduate/programs/majors/social-data-analytics/>)

DEGREE REQUIREMENTS

To qualify for the dual-title degree, students must satisfy the requirements of the Ph.D. in Recreation, Park, and Tourism Management, listed above. In addition, students pursuing the dual-title Ph.D. in Recreation, Park, and Tourism Management and Social Data Analytics must complete the degree requirements for the dual-title Social Data Analytics Ph.D., listed on the Social Data Analytics Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/social-data-analytics/>).

The qualifying examination in Recreation, Park, and Tourism Management satisfies the qualifying exam requirement for the dual-title degree program in Social Data Analytics.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>), the Ph.D. committee of a dual-title doctoral degree student must include at least one member of the Social Data Analytics Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the committee representing Recreation, Park, and Tourism Management is not also a member of the Graduate Faculty in Social Data Analytics, the member of the committee representing Social Data Analytics must be appointed as co-chair. The Social Data Analytics representative on the student's doctoral committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D.

committee and reflects their original research and education in both Recreation, Park, and Tourism Management and Social Data Analytics. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-title students may be expected to regularly attend regular research seminars in the SODA program.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Recreation, Park, and Tourism Management (RPTM) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/rptm/>)

Learning Outcomes

1. Demonstrate advanced knowledge of recreation, park, and tourism management issues.
2. Analyze and synthesize the literature from a variety of perspectives and disciplines in a specific area recreation, park, and tourism management.

3. Integrate and apply transdisciplinary concepts of recreation, park, and tourism management to contemporary issues in the field.
4. Design and implement independent research to address a contemporary issue in recreation, park, and tourism management.
5. Effectively communicate diverse and contrary perspectives regarding recreation, park, and tourism management orally and in writing.

Contact

Campus University Park

Graduate Program Head Peter Newman

Director of Graduate Studies (DGS) or Professor-in-Charge (PIC) Derrick Taff

Program Contact Stephanie Valente
801 F Ford Building
University Park PA 16802
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(814) 863-6599

Program Website View (<https://hhd.psu.edu/rptm/graduate/phd-program-recreation-park-and-tourism-management/>)

Renewable Energy and Sustainability Systems

Graduate Program Head Jeremy Gernand

Program Code RESS

Campus(es) World Campus (M.P.S.)

Degrees Conferred Master of Professional Studies (M.P.S.)

The Graduate Faculty View (<https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=RESS>)

The RESS professional master's program (MPS-RESS) is an online, interdisciplinary master's degree program designed to prepare professionals in the fields of renewable energy and sustainability systems to lead the world's transformation from an unsustainable, fossil energy economy to a renewable, sustainable basis of operation. For example, attaining an ambitious national goal of 25% of energy from renewable resources by the year 2025 in the U.S. requires a tremendous increase in renewable energy production and use in ways that are sustainable, environmentally sound, and reliable. The MPS-RESS program is designed to address the critical need for professionals with relevant expertise in *renewable energy* and *sustainability systems*.

The program provides broad coverage of topics related to *renewable energy* and *sustainability systems* while providing in-depth coverage of related technologies and policies. Students are required to follow a focused curriculum that combines requisite rigor with flexibility appropriate to a rapidly changing field. Students take a number of core program courses that provide an in-depth understanding of the sustainability framework relevant to energy and sustainability systems and, in consultation with their program adviser, select additional courses from a broad array of electives designed to meet their individual learning goals. While not required to do so, students may choose from one of two program tracks: one which provides specialized technical instruction in various aspects of renewable energy systems while the other focuses on sustainability management and policy. A comprehensive Scholarship and Academic Research Integrity (SARI) plan embeds ethics and integrity

training both at the start and at the end of the master's program. A capstone course or capstone research experience with an EME faculty member is required of all students that serves to aggregate the material learned and provide a summative educational experience within the framework of a semester long group-based project.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Educational Background

Academic performance and/or professional experience must be equivalent to that expected for admission to a typical resident-program master's degree. Applications must include a statement of professional goals, a curriculum vita or resume, and three letters of recommendation.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Core Application Packet

- Statement of Purpose: A statement of professional experience and goals (up to 500 words)
- Vita or resume
- Three letters of recommendation. The individuals writing letters should be familiar with you and comfortable discussing your professional and/or academic strengths and accomplishments. Preferably, all letters will be written within the last six months and reference the applicant's current career goals and/or ability to perform graduate level study.
- Official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>)
- Test of English as a Foreign Language (TOEFL) or International English Language Testing System (IELTS) score, if applicable
- Nonrefundable application fee

Admissions Process

Applications will be evaluated by the MPS-RESS Admissions Committee based on the applicants' technical qualifications for the program relative to their area of interest, their previous educational experience, and English Language proficiency. In general, successful applicants are expected to have earned a junior/senior grade-point average of at least 3.0 on a 4.0 scale. Applicants with a marginal record are encouraged to first complete a related Graduate Certificate before applying for admission to the MPS-RESS program. Exemplary performance in the graduate certificate will be taken into consideration for possible admission into the MPS-RESS program, but completion of a certificate does not imply or guarantee admission into a degree program.

Degree Requirements

Master of Professional Studies (M.P.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The MPS-RESS degree is conferred upon students who earn a minimum of 33 credits of course work at the 400, 500, or 800 level while maintaining an average grade-point average of 3.0 or better in all course work, including at least 18 credits at the 500 or 800 level (with at least 6 credits at the 500 level), and who complete a culminating experience (capstone course or scholarly paper) in consultation with a graduate adviser. The program curriculum includes:

- 12 credits of core courses,
- 18 credits of electives, and
- a 3-credit capstone course (EME 589) or scholarly paper (EME 596).

Substitutions for required courses, either with resident-education courses, alternate online courses, or courses from other institutions, will be considered on a case-by-case basis, and must be petitioned and approved by the Program Chair, with input from the student's adviser.

Code	Title	Credits
Required Courses		
BIOET 533	Ethical Dimensions of Renewable Energy and Sustainability Systems	3
EME 504	Foundations in Sustainability Systems	3
EME 801	Energy Markets, Policy, and Regulation	3
EME 802	Renewable and Sustainable Energy Systems	3
Additional Courses		
	Additional courses that will count as electives towards this degree can be chosen from a list of approved elective courses maintained by the graduate program office. This listing includes 2 program tracks that provide focused instruction in a given aspect of renewable energy and sustainability systems.	18
Culminating Experience		
	Choose one of the following:	3
EME 589	Management and Design of Renewable Energy and Sustainability Systems (Capstone Course)	
EME 596	Individual Studies (Scholarly Paper)	
Total Credits		33

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)

- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Energy and Mineral Engineering (EME) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/eme/>)

Learning Outcomes

1. Execute and evaluate sustainability or renewable energy systems using baseline, techno-economic, life cycle, or cost/benefit analyses.
2. Demonstrate fundamental understanding of the principles of energy science, including resource availability and conversion technologies.
3. Demonstrate an appreciation for the commercialization process relative to project and product development.
4. Demonstrate the ability to make sound decisions in complex situations.
5. Evaluate sustainability decisions in the broader context of society's interests.

Contact

Campus	World Campus
Graduate Program Head	Jeremy Michael Gernand
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Erich William Schienke
Program Contact	Noelle Fetzer Capparelle 2217 EES Bldg. University Park PA 16802 nlf5@psu.edu (814) 867-5401
Program Website	View (https://www.ress.psu.edu/)

Rural Sociology

Graduate Program Head

Laszlo Kulcsar

Program Code

RSOC

Campus(es)

University Park (Ph.D., M.S.)

Degrees Conferred

Doctor of Philosophy (Ph.D.)
Master of Science (M.S.)
Dual-Title Ph.D. and M.S. in Rural Sociology and Demography
Dual-Title Ph.D. and M.S. in Rural Sociology and Transdisciplinary Research on Environment and Society
Dual-Title Ph.D. and M.S. in Rural Sociology and International Agriculture and Development
Dual-Title Ph.D. and M.S. in Rural Sociology and Women's, Gender, and Sexuality Studies
View (<https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=RSOC>)

The Graduate Faculty

All degree programs emphasize a comprehensive understanding of the various facets of societal organization pertinent to the rural sector. While breadth is encouraged, areas of special interest and research include rural social change, community structure, population, rural community development, the structure of agriculture, natural resources, and the environment.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

GRE scores are not required for admission.

Prerequisites for the master's program include 3 credits in rural sociology or sociology, and additional credits in either field. If the entering student does not have these prerequisites, they must be made up at the University during the early part of the master's program.

Students with a 3.00 junior/senior average (on a 4.00 scale) and with appropriate course backgrounds will be considered for admission. The best-qualified applicants will be accepted up to the number of spaces that are available for new students. Exceptions to the minimum 3.00 grade-point average may be made for students with special backgrounds, abilities, and interests.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

All students are required to have training in sociological theory, statistics, and research methods.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

All students are required to have training in sociological theory, statistics, and research methods.

There is no foreign language requirement for the Ph.D. degree; the student is expected to substitute such courses and instruction necessary to generate superior capabilities of inquiry into an analysis of basic and/or applied rural sociological problems.

Dual-Titles

Dual-title M.S. and Ph.D. in Rural Sociology and Demography

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-title-graduate-degree-programs/>).

Admission Requirements

Students must apply and be admitted to the graduate program in Rural Sociology and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Demography dual-title program. Refer to the Admission Requirements section of the Demography Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/demography/>). Doctoral students must be admitted into the dual-title degree program in Demography prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Rural Sociology. In addition, students must complete the degree requirements for the dual-title in Demography, listed on the Demography Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/demography/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Rural Sociology and must include at least one Graduate Faculty member from the Demography program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Rural Sociology and Demography. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Rural Sociology and Demography dual-title Ph.D. student must include at least one member of the Demography Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Demography, the member of the committee representing Demography must be appointed as co-chair. The Demography representative on the student's Ph.D. committee

will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Rural Sociology and Demography. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title M.S. and Ph.D. in Rural Sociology and Transdisciplinary Research on Environment and Society

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-title-graduate-degree-programs/>).

ADMISSION REQUIREMENTS

Students must apply and be admitted to the graduate program in Rural Sociology and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Transdisciplinary Research on Environment and Society dual-title program. Refer to the Admission Requirements section of the Transdisciplinary Research on Environment and Society Bulletin page. Doctoral students should enroll in a dual-title graduate degree program early in their training, and no later than the end of the fourth semester (not counting summer semesters) of entry into the graduate major program.

DEGREE REQUIREMENTS

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Rural Sociology. In addition, students must complete the degree requirements for the dual-title Transdisciplinary Research on Environment and Society, listed on the Transdisciplinary Research on Environment and Society Bulletin page.

The qualifying examination for Rural Sociology will satisfy the qualifying exam requirement for the dual-title degree program in TREES. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees, the Ph.D. committee of a Rural Sociology and Transdisciplinary Research on Environment and Society dual-title Ph.D. student must include at least one member of the Transdisciplinary Research on Environment and Society Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Transdisciplinary Research on Environment and Society, the member of the committee representing Transdisciplinary Research on Environment and Society must be appointed as co-chair. The Transdisciplinary Research on Environment and Society representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D.

committee and reflects their original research and education in Rural Sociology and Transdisciplinary Research on Environment and Society. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title M.S. and Ph.D. in Rural Sociology and International Agriculture and Development

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-title-graduate-degree-programs/>).

Graduate students with research and educational experiences in rural sociology may apply to the Rural Sociology/INTAD dual-title degree program. The goal of the dual-title RSOC/INTAD degree program is to enable graduate students from RSOC to acquire the knowledge and skills of their major area of specialization in RSOC, while at the same time gaining the perspective and methods needed to work internationally. Graduate study in this program seeks to prepare students to assume leadership roles in professions in international agriculture and development requiring state-of-the-art methodological training, as well as of conceptual expertise in rural sociology and in one or more of RSOC's four signature areas:

1. agriculture and food systems,
2. community and international development,
3. natural resources and environment,
4. rural social demography.

Students must apply and be admitted to the graduate program in Rural Sociology and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the International Agriculture and Development dual-title program. Refer to the Admission Requirements section of the International Agriculture and Development Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/international-agriculture-development/>). Doctoral students must be admitted into the dual-title degree program in International Agriculture and Development prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for a dual-title degree, students must satisfy the requirements of the Rural Sociology program in which they are primarily enrolled. In addition, students must complete the degree requirements for the dual-title in International Agriculture and Development, listed on the International Agriculture and Development Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/international-agriculture-development/>).

Degree Requirements for the Dual-title M.S.

The master's in Rural Sociology and INTAD is a dual-title degree awarded to students who are admitted to the Rural Sociology master's program and admitted to the dual-title degree in INTAD. In addition to the requirements of the Rural Sociology degree, dual-title degree students must complete a minimum of 12 INTAD course credits (400, 500, or 800 level) as follows:

Code	Title	Credits
Required Courses		
AE 450		3
CEDEV 505	Leadership Development	3
INTAD 820	International Agricultural Development Seminar	3
3 credits of internship or applied courses/ independent studies with international development content		3
Total Credits		12

Some courses may satisfy both the graduate major program requirements and those of the INTAD program.

Master's Thesis & Final Oral Examination

Students must write a master's thesis on a topic that reflects both the graduate program in Rural Sociology and the dual-title offering in INTAD.

All members of the student's committee for the dual-title master's degree will be members of the Graduate Faculty. The committee must include at least one Graduate Faculty member from INTAD. A Degree Committee form should be filed upon selection of the committee members and should be approved by the INTAD Academic Program Committee Co-chair.

Students in the dual-title master's degree program in RSOC and INTAD will also be required to pass a master's thesis defense covering the general field of Rural Sociology and INTAD, with emphasis on the student's area of specialization. The oral exam is to be administered by the student's thesis committee. A favorable vote of a two-thirds majority is necessary for passing.

Degree Requirements for the Dual-Title Ph.D.

The Ph.D. degree in RSOC and INTAD is a dual-title degree awarded only to students who are admitted to the RSOC doctoral program and admitted to the dual-title degree in INTAD. The minimum course requirements for the dual-title Ph.D. degree in RSOC and INTAD, in addition to the RSOC requirements, are as follows.

Students must complete a minimum of 18 INTAD course credits with study in the following categories:

Code	Title	Credits
Required Courses		
INTAD 820	International Agricultural Development Seminar	3
RSOC 517	International Rural Social Change	3
RSOC 508	Sociology of Agriculture	3
or RSOC 555	Human Dimensions of Natural Resources	
Select 9 credits from INTAD elective curriculum/courses with international development content/internships/independent study		9
Total Credits		18

Courses totaling a minimum of 18 credits must be taken at the 500 or 800 level; particular courses may satisfy both the RSOC requirements and those in the INTAD program. Final course selection is determined by the student in consultation with their INTAD advisers and their major program advisers. Students who already hold a master's degree from another institution may petition to have equivalent course credits accepted.

Graduates of the dual-title INTAD master's degree program who wish to pursue an INTAD doctoral degree must re-apply to the INTAD program for admission. INTAD master's degree credits may be carried over to the doctoral program. Six additional INTAD credits will be required. INTAD master's degree graduates who pursue an INTAD Ph.D. are required to

take the INTAD 820 (<https://bulletins.psu.edu/search/?P=INTAD%20820>) International Agricultural Development Seminar a second time.

Qualifying Exam

The qualifying examination will be based on the procedures of the major department and will have an international dimension. Although not encouraged, the dual-title degree student may require an additional semester or more to fulfill requirements for the dual-title degree program. Therefore, under exceptional circumstances, the qualifying exam may be delayed at the discretion of the student adviser in consultation with the INTAD program coordinators. The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from RSOC and must include at least one Graduate Faculty member from the INTAD program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role.

Committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of an RSOC and INTAD dual-title Ph.D. student must include at least one member of the INTAD Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in INTAD, the member of the committee representing INTAD must be appointed as co-chair.

Comprehensive Exam

Each Ph.D. student must pass a comprehensive (combined written and oral) examination in rural sociology, research methods, and statistics, and two or more chosen areas of specialization. It is expected that one of these areas will be INTAD. A separate comprehensive examination is not required by the INTAD program, but the INTAD representative on the student's Ph.D. committee must have input into the development of and participate in the evaluation of the comprehensive examination.

Doctoral Dissertation & Final Oral Examination

Ph.D. students enrolled in the dual-title degree program are required to write a doctoral dissertation on a topic that reflects their original research and education in both Rural Sociology and International Agriculture and Development. The dissertation should contribute to the body of knowledge in international agriculture. Upon completion of the student's doctoral dissertation, a final oral examination is scheduled. The exam is administered by the student's Ph.D. committee and focuses on the student's dissertation research. A public oral presentation of the dissertation is also required. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School, and the student must pass the final oral examination.

Dual-Title M.S. and Ph.D. in Rural Sociology and Women's, Gender, and Sexuality Studies

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-title-graduate-degree-programs/>).

Admission Requirements

Students must apply and be admitted to the graduate program in Rural Sociology and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Women's, Gender, and Sexuality Studies dual-title program. Refer to the Admission Requirements section of the Women's,

Gender, and Sexuality Studies Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/womens-gender-sexuality-studies/>). Doctoral students must be admitted into the dual-title degree program in Women's, Gender, and Sexuality Studies prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Rural Sociology. In addition, students must complete the degree requirements for the dual-title in Women's, Gender, and Sexuality Studies, listed on the Women's, Gender, and Sexuality Studies Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/womens-gender-sexuality-studies/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Rural Sociology and must include at least one Graduate Faculty member from the Women's, Gender, and Sexuality Studies program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Rural Sociology and Women's, Gender, and Sexuality Studies. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Rural Sociology and Women's, Gender, and Sexuality Studies dual-title Ph.D. student must include at least two members of the Women's, Gender, and Sexuality Studies Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Women's, Gender, and Sexuality Studies, the member of the committee representing Women's, Gender, and Sexuality Studies must be appointed as co-chair. The Women's, Gender, and Sexuality Studies representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Rural Sociology and Women's, Gender, and Sexuality Studies. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)

- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Rural Sociology (RSOC) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/rsoc/>)

Learning Outcomes

Master of Science (M.S.)

1. Graduates will be able to demonstrate conceptual understanding in core rural sociological theory and research methods and ethics at the level required to contribute to the discipline and/or practice.
2. Graduates will be able to critically analyze the work of others in their field and apply that knowledge to problems of domestic and/or global interest.
3. Graduates will be able to synthesize theory and empirical literature to generate innovative approaches to research and execute a research strategy and explore implications for policy and/or practice.
4. Graduates will be able to effectively convey sociological ideas, arguments, and findings in formal presentations and in written work.
5. Graduates will demonstrate the ability to collaborate in a collegial and ethical manner with other professionals and a commitment to active citizenship in society at large.

Doctor of Philosophy (Ph.d.)

1. Graduates will be able to demonstrate deep conceptual understanding and proficiency in core rural sociological theory, research methods and ethics, as well as mastery in two selected concentration areas at the level required to contribute to the discipline.
2. Graduates will be able to critically analyze the work of others in their field and apply that knowledge to problems of domestic and/or global interest.
3. Graduates will be able to synthesize theory and empirical literature to generate innovative approaches to research and execute a research

strategy to create new scientific knowledge and explore implications for policy and/or practice.

4. Graduates will be able to effectively convey sociological ideas, arguments, and findings in formal presentations and in written works to scholars in the field and to policy audiences.
5. Graduates will demonstrate the ability to collaborate in a collegial and ethical manner with other professionals within and across disciplines and demonstrate a commitment to active citizenship in the discipline and society at large.

Contact

Campus	University Park
Graduate Program Head	Laszlo Kulcsar
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Brian Clemens Thiede
Program Contact	Kayla Sgobba 201 Armsby Building AESE/PSU University Park PA 16802 kam6227@psu.edu (814) 867-0285
Program Website	View (http://aese.psu.edu/graduateprograms/rural-sociology/)

Russian and Comparative Literature

Graduate Program Head	Daniel Purdy
Program Code	RUSCL
Campus(es)	University Park (M.A.)
Degrees Conferred	Master of Arts (M.A.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=RUSCL)

The Department of Germanic and Slavic Languages and Literatures offers a master's degree in Slavic Studies. This M.A. program enables students to concentrate in Ukrainian and Russian literature at the graduate level while having the advantages of a comparative context. Students completing this M.A. will acquire an in-depth understanding of Russian and Ukrainian culture and will be proficient in Russian or Ukrainian and one other world language, or a related field. This program can prepare students for further graduate study in Russian, Slavic studies, or comparative literature, for service with governmental or non-governmental organizations, or for employment with an international corporation.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students with appropriate course backgrounds and a 3.00 junior/senior average (on a 4.00 scale) will be considered for admission. Scores from the Graduate Record Examination (GRE) are required. It is expected that students entering this degree program will have proficiency in the Russian language and will have completed a B.A. in Russian or Comparative Literature. Students in other humanistic fields such as

philosophy or history who have studied some literature and are proficient in Russian are welcome to apply.

Degree Requirements

Master of Arts (M.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Candidates for the M.A. degree must earn a minimum of 33 credits at the 400, 500, or 800 level of which at least 18 must be at the 500 level. There are 30 credits required in the following:

Code	Title	Credits
Required Courses		
CMLIT 501	Comparative Method in Literary Studies	3
RUS 405	Seminar in Russian Literature	3
Select 12 additional credits in Comparative Literature courses		12
Select 12 additional credits in Russian at the 400 or 500 level		12
Select 3 credits in Russian, Comparative Literature, or another approved area		3
<i>Additional Requirements</i>		
Pass a proficiency examination in Russian		
Demonstrate reading knowledge of one other foreign language		
Culminating Experience		
Complete an acceptable M.A. scholarly paper		
Total Credits		33

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/>)

gsad/gsad-900/gsad-901-graduate-assistants/) set by The Graduate School.

A number of teaching assistantships are available in the Departments of Comparative Literature and Germanic and Slavic Languages and Literatures for students taking advanced degrees in these disciplines. There is also a graduate assistant position for an editorial assistant.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Comparative Literature (CMLIT) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/cmlit/>)

Russian (RUS) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/rus/>)

Contact

Campus	University Park
Graduate Program Head	Daniel Leonhard Purdy
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Samuel Mark Frederick
Program Contact	William Whitesmith 442 Burrowes Building University Park PA 16802 wmw5235@psu.edu (814) 863-3522
Program Website	View (http://german.la.psu.edu/slavic/)

School Psychology

Graduate Program Head	P Karen Murphy
Program Code	SPSY
Campus(es)	University Park (Ph.D., M.S., M.Ed.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Master of Education (M.Ed.) Dual-Title Ph.D., M.S., and M.Ed. in School Psychology and Comparative and International Education
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=SPSY)

This intercollege program is based primarily on courses in educational psychology, psychology, and special education. In addition, courses are often drawn from counselor education, human development and family studies, educational theory and policy, educational administration, and curriculum and instruction. The objective is to develop a psychologist capable of providing health care who is interested in and knowledgeable about education and psychology in the school setting. The school psychologist must utilize professional skill and knowledge about children

and youth to make contributions that are meaningful to and utilized by teachers, other school personnel, and parents. The development of competencies needed by a fully qualified school psychologist requires at least the education represented by a doctoral degree.

Practicum facilities, in addition to those in nearby public schools, include:

- the Center for Educational Diagnosis and Remediation,
- the School Psychology Clinic,
- the Communication Disorders Clinic,
- the Reading Center, and
- the Psychology Clinic.

Facilities for work with children are also available through other academic units, as well as through assistantship assignments.

The program has been accredited by the American Psychological Association, the National Commission for Accreditation in Teacher Education (NASP), and the Pennsylvania Department of Education.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Only those students who anticipate a doctoral degree will be admitted. Students are selected within the limitations of program facilities. Priority is given to applicants with work experience with children.

An undergraduate major emphasizing work in psychology and/or education is preferred, but students with fewer than 20 upper-division credits in psychology, educational psychology, or special education may be admitted with limited deficiencies to be fulfilled concurrently with their graduate work. Requirements for admission include:

- a minimum of one-third of graduate credits of A quality;
- undergraduate GPA of B or higher;
- satisfactory recommendations from two or more professors, preferably psychologists; and
- a score of 1000 or higher on the two general sections or a score of 1500 or higher, including the analytical or an advanced test, of the Graduate Record Examination.

Exceptions may be made for students with special backgrounds, abilities, and interests.

Degree Requirements

Master of Education (M.Ed.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students qualifying for a certificate to practice in the schools must meet standards specified by the Pennsylvania Department of Education. These include, but are not limited to,

- a master's degree,
- about 60 graduate credits,

- practicum experiences, and
- successful completion of precertification tests.

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Students entering the program with a bachelor's degree complete the M.S. as prescribed by the Graduate School.

Students qualifying for a certificate to practice in the schools must meet standards specified by the Pennsylvania Department of Education. These include, but are not limited to,

- a master's degree,
- about 60 graduate credits,
- practicum experiences, and
- successful completion of precertification tests.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Students may be admitted with a master's degree from school psychology programs from other institutions or from related programs in this or other universities. The doctoral program includes:

- a predissertation research requirement;
- the core program described here (which qualifies the candidate for a school psychology certificate);
- a special proficiency of 6 to 18 credits;
- an internship; and
- a dissertation.

Students completing the School Psychology Core Program will have courses in:

- the biological bases of behavior,
- the cognitive bases of behavior,
- the social bases of behavior,
- personality theory or abnormal psychology,
- human development,
- professional ethics and standards,
- research design and methodology,
- statistics,
- psychometrics,
- counseling theory,
- educational foundations,
- educational administration,
- the education of exceptional children, and
- curriculum.

Dual-Titles

Dual-Title M.Ed., M.S., and Ph.D. in School Psychology and Comparative and International Education

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://>

gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/).

Admission Requirements

Students must apply and be admitted to the graduate program in School Psychology and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Comparative and International Education dual-title program. Refer to the Admission Requirements section of the Comparative and International Education Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/comparative-international-education/>). Doctoral students must be admitted into the dual-title degree program in Comparative and International Education prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in School Psychology. In addition, students must complete the degree requirements for the dual-title in Comparative and International Education, listed on the Comparative and International Education Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/comparative-international-education/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from School Psychology and must include at least one Graduate Faculty member from the Comparative and International Education program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both School Psychology and Comparative and International Education. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a School Psychology and Comparative and International Education dual-title Ph.D. student must include at least one member of the Comparative and International Education Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Comparative and International Education, the member of the committee representing Comparative and International Education must be appointed as co-chair. The Comparative and International Education representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in School Psychology and Comparative and International Education. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

School Psychology (SPSY) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/spsy/>)

Professional Licensure/Certification

Many U.S. states and territories require professional licensure/certification to be employed. If you plan to pursue employment in a licensed profession after completing this program, please visit the Professional Licensure/Certification Disclosures by State (<https://www.psu.edu/state-licensure-disclosures/>) interactive map.

Contact

Campus	University Park
Graduate Program Head	P Karen Murphy
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	James Clyde Diperna
Program Contact	Corey Joseph Knight 125 CEDAR Building University Park PA 16802 cjk6403@psu.edu
Program Website	View (http://www.ed.psu.edu/educ/epcse/school-psychology/)

Social and Behavioral Neuroscience

Graduate Program Head	Lisa Gatzke-Kopp
Program Code	SBN
Campus(es)	University Park
Degrees Conferred	Dual-Title
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=SBN)

Students electing this degree program through participating programs earn a degree with a dual-title at the Ph.D. level, i.e., in (graduate program name) and Social and Behavioral Neuroscience.

The following graduate programs offer a dual degree in Social and Behavioral Neuroscience: Ph.D. in Biobehavioral Health and Social and Behavioral Neuroscience; Ph.D. in Communication Sciences and Disorders and Social and Behavioral Neuroscience; Ph.D in Human Development and Family Studies and Social and Behavioral Neuroscience; Ph.D. in Psychology and Social and Behavioral Neuroscience.

The Social and Behavioral Neuroscience dual-title degree program is administered by the Social and Behavioral Neuroscience Steering Committee, which is responsible for the management of the program. The committee oversees the general direction of the program, identifies faculty and courses appropriate to the program, recommends policy and procedures for the program's operation to the Dean of the Graduate School, and is an advisory body to the program Director. The program enables students from participating graduate programs to obtain foundational graduate-level training in neuroscience as well as expertise in social and behavioral neuroscience theory, research, and methods. This dual-title training will enable rigorous research at the intersection of neuroscience and the students' partner discipline. To pursue a dual-title degree under this program the student must apply to the Graduate School and register through one of the approved graduate programs.

Admission Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Before they can apply for admission to the dual-title degree program, students must apply and be admitted to their primary graduate program and the Graduate School. Applicants who are interested in the dual-title degree program will have the opportunity to indicate this interest when applying to their primary graduate programs. In their statements of

purpose for admission to their primary graduate program, applicants may also comment on how their interests in the primary graduate program are related to their interests in Social and Behavioral Neuroscience.

Students may apply for enrollment in the dual-title degree program in Social and Behavioral Neuroscience during their first year (second semester) or second year in their primary graduate program. To apply, a student must submit a letter of application, graduate and undergraduate transcripts, and a letter of recommendation from their graduate adviser. Applications will be reviewed by the Social and Behavioral Neuroscience Admissions Committee. The composition of the admissions committee will be determined by the program Steering Committee. At a minimum applicants must be in good standing in their primary graduate program and be recommended for admission by their graduate adviser. Students must be admitted into the dual-title degree program in Social and Behavioral Neuroscience prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

To qualify for the dual-title degree, students must satisfy the requirements of their primary graduate program in which they are primarily enrolled. In addition, they must satisfy the requirements described below, as established by the Social and Behavioral Neuroscience Steering Committee.

The minimum course work requirements for the dual-title Ph.D. degree in Social and Behavioral Neuroscience are as follows:

Code	Title	Credits
Required Courses		
Course work and other requirements of the primary program.		
NEURO 520	Cellular and Molecular Neuroscience	3
SBN 590	Colloquium (1 credit, taken twice)	2
Select 3 credits from the following:		3
NEURO 511	Neurobiology II	
NEURO 512	Comparative Neuroanatomy	
BIOL 478	COMPARATIVE NEUROANATOMY	
Select a minimum of 9 credits from the following:		9
NEURO 521	Systems Neuroscience	
SBN 505	Seminar in Social and Behavioral Neuroscience	
SBN 508	Methods in Social and Behavioral Neuroscience ¹	
SBN 511	Translational Applications of Social and Behavioral Neuroscience ¹	
HDFS 502	Biological Systems in Developmental Context	
HDFS 512	Developmental Cognitive Neuroscience of Adolescence	
PSY 524	Proseminar in Cognitive Psychology	
Total Credits		17

¹ SBN 505, SBN 508, and SBN 511 can be taken more than once, if this involves sections with different topics. Primary graduate programs will determine whether a given section of the SBN courses can fulfill their requirements.

The dissertation must involve the integration of neuroscience and a research question of interest within the primary graduate program.

Selection of specific courses is made by the student in consultation with an adviser from the primary graduate program and an adviser from the Social and Behavioral Neuroscience program. Primary graduate programs may add additional distributional requirements.

Students or faculty may request that the Social and Behavioral Neuroscience Steering Committee consider approval of other courses, including one-time approval for an experimental or variable-title course. The Steering Committee may delegate this approval process to the program Director, in consultation with academic advisers from a student's primary graduate program and Social and Behavioral Neuroscience.

Qualifying Exam

The dual-title degree will be guided by the Qualifying Exam procedure of the primary graduate program and the Graduate Council. In accordance with Graduate Council policy, the Qualifying Examination requirement shall be satisfied by one of the following:

1. Ideally, a single Qualifying Examination that incorporates content from both the graduate major program and Social and Behavioral Neuroscience is preferred. Dual-title degree students may request an additional semester to fulfill requirements for both areas of study and, therefore, the Qualifying Exam may be delayed one semester beyond the normal period allowable. The qualifying examination committee must include at least one member of the Social and Behavioral Neuroscience Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role.
 - a. In cases where the timing of the Qualifying Examination in the graduate major program precludes the inclusion of the dual-title, an examination demonstrating proficiency in Social and Behavioral Neuroscience may occur at a later time, but no later than the end of the fourth semester (not counting summer semesters) of entry into the major doctoral program. In cases where separate Qualifying Examinations are administered, Graduate Faculty from both the graduate major program and SBN will administer the SBN Qualifying Examination.
2. With prior approval from the SBN Professor-in-Charge, the dual-title program in Social and Behavioral Neuroscience may allow the Qualifying Examination in Biobehavioral Health alone to satisfy the requirements for the dual-title program.

Ph.D. Committee Composition

The Ph.D. committee must conform to all requirements of the primary graduate program and the Graduate Council. In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>), the Ph.D. committee of a Social and Behavioral Neuroscience dual-title doctoral degree student must include at least one member of the Social and Behavioral Neuroscience Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Social and Behavioral Neuroscience, a member of the committee representing Social and Behavioral Neuroscience must be appointed as co-chair.

Comprehensive Exam

The dual-title degree will be guided by the Comprehensive Exam procedure of the primary graduate program. After completion of required course work, doctoral students enrolled in the dual-title doctoral degree must pass a comprehensive examination. In programs where this includes evaluation of a written exam, the Social and Behavioral Neuroscience representative on the student's Ph.D. committee will participate in the writing and evaluation of the exam, in accordance with procedures maintained by the primary graduate program. In programs where the comprehensive exam involves defense of a dissertation prospectus, the Social and Behavioral Neuroscience representative on the student's Ph.D. committee will participate in the evaluation of the prospectus, including ensuring the proposed dissertation has substantial Social and Behavioral Neuroscience content.

Dissertation and Dissertation Defense

Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. Students enrolled in the dual-title program are required to write and orally defend a dissertation on a topic that reflects their original research and education in their primary graduate discipline and in Social and Behavioral Neuroscience. The dissertation must be accepted by the Ph.D. committee, the heads of both graduate programs, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by

graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **KNOW:** Graduates will demonstrate an understanding of functional and structural neuroanatomy as pertains to the central nervous system. Graduates will be able to describe what and how specific assessment tools used in their research assess about central nervous system function, including the limitations of the technique.
2. **THINK:** Graduates will evaluate comparative research to develop research questions pertaining to the role of the brain in human behavior.
3. **APPLY/CREATE:** Graduates will apply their knowledge of neuroscience to the selection of appropriate measurement techniques to test hypotheses related to how mechanisms transact across at least two levels of analysis (e.g. brain and behavior) in their dissertation research.
4. **COMMUNICATE:** Graduates will communicate, in both written and oral formats, the importance and relevance of a research topic as well as the implications research results have for the field.
5. **PROFESSIONAL PRACTICE:** Graduates will comply with standard ethical regulations regarding the conduct of research, knowledge of ethical guidelines regarding the analysis and publication of scientific research.

Contact

Campus	University Park
Graduate Program Head	Lisa Michelle Kopp
Program Contact	Lisa Michelle Kopp lmk18@psu.edu (814) 867-2371
Program Website	View (https://hhd.psu.edu/hdfs/graduate/dual-title-phd-programs/social-and-behavioral-neuroscience/)

Social Data Analytics

Graduate Program Head	Bruce Desmarais
Program Code	SODA
Campus(es)	University Park
Degrees Conferred	Dual-Title
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=SODA)

Students electing this degree program through participating programs earn a degree with a dual-title at the Ph.D. level, i.e., in (graduate program name) and Social Data Analytics.

The following graduate programs offer a dual-title degree in Social Data Analytics:

- Ph.D in **Criminology** and Social Data Analytics
- Ph.D in **Human Development and Family Studies** and Social Data Analytics
- Ph.D. in **Informatics** and Social Data Analytics

- Ph.D. in **Political Science** and Social Data Analytics
- Ph.D. in **Psychology** and Social Data Analytics
- Ph.D in **Recreation, Park, and Tourism Management** and Social Data Analytics
- Ph.D. in **Sociology** and Social Data Analytics
- Ph.D. in **Statistics** and Social Data Analytics

The Social Data Analytics dual-title degree program is administered by the Social Data Analytics Committee, which is responsible for the management of the program. The committee maintains program definition, identifies faculty and courses appropriate to the program, and recommends policy and procedures for its operation to the Dean of the Graduate School. The program enables students from diverse graduate programs to attain and be identified with an interdisciplinary array of tools, techniques, and methodologies for social data analytics, while maintaining a close association with a home discipline. Social data analytics is the integration of social scientific, computational, informational, statistical, and visual analytic approaches to the analysis of large or complex data that arise from human interaction. To pursue a dual-title degree under this program the student must apply to the Graduate School and register through one of the approved graduate programs.

Admission Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Students must apply and be admitted to the graduate program in their primary graduate program and The Graduate School before they can apply for admission to the dual-title degree program. Applicants interested in the dual-title degree program may make their interest in the program known on their applications to the primary graduate program and include remarks in their statement of purpose that address the ways in which their research and professional goals in their chosen primary field reflect an expanded interest in Social Data Analytics.

To be enrolled in the dual-title doctoral degree program in Social Data Analytics, a student must submit a letter of application and transcript, which will be reviewed by the Social Data Analytics Admissions Committee. An applicant must have a minimum grade point average of 3.0 (on a 4-point scale) to be considered for enrollment in the dual-title degree program. Students must be admitted into the dual-title degree program in Social Data Analytics no later than the end of the fourth semester (not counting summer semesters) of entry into the primary Ph.D. program and before taking the comprehensive exam.

Degree Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

To qualify for the dual-title degree, students must satisfy the requirements of the primary graduate program in which they are enrolled. In addition, they must satisfy the requirements described below, as established by the Social Data Analytics Committee.

The minimum course work requirements for the dual-title Ph.D. degree in Social Data Analytics are as follows:

- Course work and other requirements of the primary program.
- SODA 501 (3 credits)
- SODA 502 (3 credits)
- 12 or more elective credits in Social Data Analytics from a list of courses maintained by the Social Data Analytics Committee. Collectively the elective credits must satisfy the following requirements:
 - (A) Core analytics distribution. 3 or more credits in courses focused on statistical learning, machine learning, data mining, or visual analytics. Courses approved as meeting this requirement are designated (A) on the list of approved electives.
 - (Q) Quantification distribution. 6 or more credits in courses focused on statistical inference or quantitative social science methodology. Courses approved as meeting this requirement are designated (Q) on the list of approved electives.
 - (C) Computational / informational distribution. 6 or more credits in courses focused on computation, collection, management, processing, or interaction with electronic data, especially at scale. Courses approved as meeting this requirement are designated (C) on the list of approved electives.
 - (S) Social distribution. 6 or more credits in courses with substantial content on the nature of human interaction and/or the analysis of data derived from human interaction and/or the social context or ethics or social consequences of social data analytics. Courses approved as meeting this requirement are designated (S) on the list of approved electives.
 - Cross-departmental distribution.
 - 3 or more credits in approved courses with the prefix STAT or that of a primarily social science department.
 - 3 or more credits in approved courses with the prefix IST, GEOG, or that of a primarily computer science or engineering department.
 - 6 or more credits in approved courses outside the primary program.
 - 3 or fewer credits in approved courses at the 400-level.

Students or faculty may request that the Social Data Analytics Committee consider approval of elective designations for any course, including temporary approvals for experimental or variable-title courses. Students are encouraged to take interdisciplinary courses that carry multiple (A), (Q), (C), (S) designations, as well as to select SODA electives that also meet requirements of the primary program. Within this framework, final course selection is determined by the student in consultation with academic advisers from their home department and Social Data Analytics.

The Social Data Analytics Program maintains a list of background and skills that it recommends students have in place by the time they begin the interdisciplinary coursework required to complete the Social Data Analytics degree.

Qualifying Examination

The qualifying examination in the primary graduate degree program satisfies the qualifying exam requirement for the dual-title degree program in Social Data Analytics.

Ph.D. committee Composition

The Ph.D. committee must conform to all requirements of the primary graduate program and the Graduate Council. In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd->

[dissertation-committee-formation/](http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-)), the Ph.D. committee of a Social Data Analytics dual-title doctoral degree student must include at least one member of the Social Data Analytics Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Social Data Analytics, the member of the committee representing Social Data Analytics must be appointed as co-chair.

Comprehensive Exam

The dual-title degree will be guided by the comprehensive exam procedure of the primary graduate program. After completion of required course work, doctoral students in the dual-title doctoral degree program must pass a comprehensive examination. In programs where this includes evaluation of a written exam, the Social Data Analytics representative on the student's Ph.D. committee will participate in the writing and evaluation of the exam, in accordance with procedures maintained by the primary graduate program. In programs where the comprehensive exam involves defense of a dissertation prospectus, the Social Data Analytics representative on the student's Ph.D. committee will participate in the evaluation of the prospectus, including ensuring the proposed dissertation has substantial Social Data Analytics content.

Dissertation and Dissertation Defense

Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. Students enrolled in the dual-title program are required to write and orally defend a dissertation on a topic that reflects their original research and education in their home discipline and Social Data Analytics. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Social Data Analytics Doctoral Minor

Requirements listed here are in addition to requirements for minors in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Doctoral students may take a doctoral minor in Social Data Analytics. This is the appropriate option for doctoral students in programs that have not adopted the dual-title Ph.D. degree in Social Data Analytics, and for students otherwise pursuing an incompatible degree program, such as another dual-title.

As with all graduate minors, a student seeking a minor must have the approval of the student's major program of study, the Social Data Analytics program, and the Graduate School, and official requests to add a minor to a doctoral student's academic record must be submitted to Graduate Enrollment Services prior to establishing the Ph.D. committee and prior to scheduling the comprehensive examination. At least one Graduate Faculty member from Social Data Analytics must serve on the student's Ph.D. committee.

The doctoral minor in Social Data Analytics requires at least 15 credits in approved courses, with at least 6 at the 500 level, and a minimum of 9 elective credits from a list of approved electives maintained by the Social Data Analytics program. Additional deviations from distribution minimums and maximums may be allowed, but must be approved by the Social Data Analytics program.

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Social Data Analytics (SODA) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/soda/>)

Learning Outcomes

The curriculum of the Dual-title degree program in Social Data Analytics is designed to develop PhDs with the skills, experience and instincts to lead science and broader society in engaging and addressing the challenges and opportunities arising from big social data. The learning objectives for each student who completes the program are:

1. Combining Social Science and Computational Science: With training in social science disciplines and statistical, computational, visual analytics, students cultivate an understanding of how social research is conducted with advanced analytical approaches.
2. Contributing to the field of Social Data Analytics: Students in the program learn how to, through their own research programs, expand the capabilities of the multidisciplinary field of social data analytics, and use those capabilities creatively to answer important social scientific questions and to address grand social challenges.
3. Understand basic and applied use of social data analytics: Students in the program will understand how to use and apply their research skills in both academic and private sector employment settings.
4. Diverse and ethical perspectives on Social Data Analytics: The training in the SoDA program leads students to instinctively consider diverse and multinational perspectives on social data issues, to instinctively and effectively prioritize ethics, scientific responsibility, and social consequences in the creation and use of social data, and to communicate effectively with both scientific and nonscientific audiences.

Contact

Campus	University Park
Graduate Program Head	Bruce A Desmarais
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Bruce A Desmarais
Program Contact	Kristy Michelle Boob 221 Pond Lab University Park PA 16801 kmc248@psu.edu (814) 863-1595
Program Website	View (https://soda.la.psu.edu/programs/graduate-program/)

Social Work

Graduate Program Head	Douglas Teti
Program Code	MSW
Campus(es)	World Campus (M.S.W.)
Degrees Conferred	Master of Social Work (M.S.W.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=MSW)

The Penn State World Campus Master of Social Work program involves online coursework and in-person supervised fieldwork. Students concentrate in clinical social work and specialize in one of two areas: 1) children and families across the lifespan; or 2) mental health and substance use.

The MSW program prepares students for advanced clinical social work practice in a range of settings. The master's program is designed to address the wide range of skills and functions required of a professional social worker. Upon successful program completion, students can sit for licensure to become a Licensed Clinical Social Worker (LCSW) in Pennsylvania and other states.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

ADMISSIONS CRITERIA. We seek students passionate about helping their communities and striving for economic and social justice. Applicants must exhibit potential and professional capabilities essential for effective functioning in the graduate school environment. Applicants must also have personal qualifications essential for effective social work practice, including sensitivity and responsiveness in relationships, concern for the needs of others, adaptability, good judgement, critical thinking, creativity, integrity, and skill in oral and written communications.

An applicant must meet the following requirements:

- A bachelor's degree with a broad liberal arts foundation from an accredited college or university
- A minimum average of a B (3.0 GPA on a 4 point scale) in all undergraduate work
- No admissions test (e.g., GRE) are required for admission.

Consistent with the Council for Social Work Education's Educational Policies and Accreditation Standards, the Penn State World Campus MSW program does not grant course credit, transfer credit, or exemptions for prior life, volunteer, or employment experience.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Advanced Standing

Students who have received a social work degree (BSW) within the past five years and have a minimum 3.25 GPA from a Council for Social Work Education accredited undergraduate program are eligible for advanced standing. Students who are granted advanced standing during the admissions process can receive credit for the generalist courses offered during Year 1 of full-time study. The number of advanced credits granted depends on the comparability of the student's undergraduate courses to the Penn State World Campus MSW program's courses and on the grades earned in those undergraduate course (i.e., must be a B grade or higher).

In addition, students entering with advanced standing can receive six (6) field education credits. The six credits of field education are granted based on the number of hours of field experience completed at the undergraduate level, provided that the undergraduate social work practicum totals a minimum of 400 hours and the student achieved at least a B grade.

Application Components

- A completed Graduate School online application form with the application fee
- Official transcripts from all post-secondary institutions attended
- Resume or CV
- Goal Statement
- Letters of Reference

Degree Requirements

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students must receive a minimum of a B grade in all courses and field work. Required courses are:

Code	Title	Credits
MSW 510	Research Methods in Clinical Social Work Practice	3
MSW 560	Applied Research in Clinical Social Work Practice	3
MSW 800	Foundations of Field Education 1 ¹	3
MSW 801	Foundations of Field Education 2 ²	3
MSW 802	Specialized Field Education 1 ³	3
MSW 811	Foundations in Clinical Social Work Practice 1	3
MSW 812	Foundation in Clinical Social Work Practice 2	3
MSW 813	Human Development in the Social Environment	3
MSW 814	Social Welfare Policy	3
MSW 815	Clinical Social Work Practice Across the Lifespan 1	3
MSW 816	Clinical Social Work Practice Across the Lifespan 2	3

MSW 850	Diagnosis and Assessment in Clinical Social Work Practice	3
MSW 855	Essential Skills for Clinical Social Work Practice	3
MSW 865	Clinical Social Work Practice in Urban and Rural Settings	3
MSW 870	Clinical Social Work Practice with Children and Families 1	3
or MSW 880	Clinical Social Work Practice in Mental Health and Substance Use 1	
MSW 875	Policy Issues with Children and Families	3
or MSW 885	Policy Issues in Mental Health and Substance Use	
MSW 871	Clinical Social Work Practice with Children and Families 2	3
or MSW 881	Clinical Social Work Practice in Mental Health and Substance Use 2	
MSW 876	Trauma and Treatment with Children and Families	3
or MSW 886	Trauma and Treatment in Mental Health and Substance Use	
MSW 894	Specialized Field Education 2 ⁴	3
Total Credits		57

¹ MSW 800A, MSW 800B, MSW 800C may be taken in series to fulfill this requirement on a part-time basis.

² MSW 801A, MSW 801B, MSW 801C may be taken in series to fulfill this requirement on a part-time basis.

³ MSW 802A, MSW 802B, MSW 802C may be taken in series to fulfill this requirement on a part-time basis.

⁴ MSW 894A, MSW 894B, MSW 894C may be taken in series to fulfill this requirement on a part-time basis.

MSW 894 represents the capstone project necessary for graduation. Students identify an issue or problem in the field site agency, analyze the issue, and develop a solution/recommendation. Students will present their capstone project in an oral presentation as well as submit an executive summary.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Social Work (MSW) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/msw/>)

Learning Outcomes

1. **KNOW:** Demonstrate knowledge of clinical social work practice theories and techniques and apply them to clinical social work practice.
2. **APPLY/CREATE:** Apply trauma-informed intervention techniques to clinical social work practice.
3. **THINK:** Demonstrate knowledge of DSM criteria and apply that knowledge to diagnosis and treatment.
4. **PROFESSIONAL PRACTICE:** Understand and apply the ethical standards of the National Association of Social Workers (NASW) to professional practice.
5. **COMMUNICATE:** Identify the unique strengths and challenges of working in rural versus urban environments and apply to clinical social work practice.

Contact Sociology

Graduate Program Head	Michelle Frisco
Program Code	SOC
Campus(es)	University Park (Ph.D., M.A.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Arts (M.A.) Dual-Title Ph.D. and M.A. in Sociology and Demography Dual-Title Ph.D. in Sociology and Social Data Analytics
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=SOC)

The graduate program in Sociology offers advanced education for students who intend to pursue academic careers in sociology or who aspire to nonacademic research positions.

The M.A. and Ph.D. programs provide training in general social theory, research methodology, statistics, and a number of traditional and developing substantive specialties. In consultation with faculty advisers, students select specialties that are among the department's strengths, such as demography (including health and immigration); families, relationships and interpersonal networks; quantitative methods; social

networks; social institutions and culture; social inequality; urban, community, and spatial sociology; immigration and incorporation; and health and life course.

Alternate specialty areas not listed above may be selected with the approval of the Graduate Director and the student's dissertation committee. Students may also elect to pursue a dual-title M.A. and Ph.D. in Sociology and Demography; a dual-title Ph.D. in Sociology and Social Data Analytics; and a minor in Social Thought. A separate Ph.D. program in Criminology (<http://bulletins.psu.edu/graduate/programs/majors/criminology/>) is also housed within the department.

All students who intend to pursue doctoral work are expected to earn (or have earned) an M.A. degree in their normal progress to the Ph.D.

Course work outside the department is encouraged. Areas of study related to sociology, such as rural sociology, geography, economics, business administration, statistics, anthropology, political science, labor and employment relations, women's studies, social thought, biobehavioral health, and human development and family studies are available at the University.

Special department-related research and training facilities include on-site computer laboratories and the Population Research Institute, the Criminal Justice Research Center, and the Pennsylvania Commission on Sentencing.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Applications will be accepted through January 1 for fall admission the following year. Selection is based on:

- undergraduate grades (and where applicable, record of previous graduate work);
- letters of recommendation;
- statement of purpose;
- areas of interest, and career goals;
- a sample of written work, such as a term paper; and
- Graduate Record Examinations (GRE) verbal, quantitative, and writing scores.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

The best-qualified applicants will be accepted up to the number of spaces available. Students with limited prior training in sociology may be accepted, with the provision that they make up background deficiencies in the early part of their graduate program in consultation with and under the supervision of the Graduate Director. Acceptance into or continuation in the program is contingent on successful performance in these areas.

Degree Requirements

Master of Arts (M.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Required courses for the M.A. are designed to enhance students' knowledge of substantive specialty areas in sociology, social theory, sociological research methods, and statistics and include:

Code	Title	Credits
Required Courses		
SOC 502	Theories of Society I	3
or SOC 503	Theories of Society II	
SOC 513	Sociological Research Methods	3
SOC 574	Statistical Methods for Social Research ¹	3
SOC 575	Statistical Models for Nonexperimental Research	3
SOC 596	Individual Studies (Computer lab accompanying SOC 574 and SOC 575.)	1
SOC 500	Introduction to Graduate Study in Sociology	1
Electives		
	Students are also required to complete six elective graduate seminars, one of which must be a 500-level substantive seminar in Criminology, and two of which may be outside the department.	18
Culminating Experience		
SOC 600	Thesis Research	6
Total Credits		38

¹ Sociology department seminars in research methods and statistics assume a background gained through some combination of undergraduate course work and individual study. Students who are not confident of their basic statistical training may find it useful to pursue foundational training at Penn State or elsewhere prior to enrollment in SOC 574.

For the M.A. in Sociology at Penn State, 38 course credits are required, no more than three of which may be for SOC 596. A minimum grade-point average of 3.00 for work done at Penn State is required for graduation.

Students must either complete an M.A. thesis by the end of their second year in the program or enter the program with an M.A. degree.

Doctor of Philosophy (ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Qualifying Exam

A qualifying examination is required of all students seeking the Ph.D. This evaluation by the departmental Graduate Committee is based on the student's seminar papers, their proposed dissertation research and record of course performance, and faculty assessments of the student's ability to complete a high-quality Ph.D. program. The qualifying examination occurs after the M.A. degree has been completed.

The Ph.D. committee

The student's Ph.D. studies are conducted under the supervision of a Ph.D. committee. The Ph.D. committee must comply with the Graduate Council Ph.D. committee requirements (<http://gradschool.psu.edu/>

[graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/](http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/)). The committee must include faculty members having recognized expertise in the major and minor areas of specialization selected by the student, as well as expertise in general social theory, research methods, and statistics. One faculty member is designated chair of the Ph.D. committee; ordinarily this person also serves as general adviser and director of the dissertation. Students are strongly encouraged to choose a committee chair as early as possible. The student's chair can be of great help in selecting other committee members, especially members outside of the sociology department.

Students must identify and convene their Ph.D. committee no later than one semester following their qualifying examination. The Ph.D. committee supervises the Ph.D. student's course of study, comprehensive examination, and dissertation. This includes approval of proposed course work to meet requirements for the major and minor areas of specialty.

All Ph.D. students must have completed all courses required for the M.A. degree in Sociology at Penn State, or their equivalent. These include:

Code	Title	Credits
Required Courses		
SOC 500	Introduction to Graduate Study in Sociology	1
SOC 574	Statistical Methods for Social Research	3
SOC 575	Statistical Models for Nonexperimental Research	3
SOC 513	Sociological Research Methods	3
SOC 502	Theories of Society I	3
or SOC 503	Theories of Society II	
Total Credits		13

All Ph.D. candidates are also required to complete a one-credit Lab in Teaching Sociology (SOC 591). The lab in teaching sociology cannot serve to meet other Ph.D. requirements to be described subsequently, such as the requirement for a minimum number of seminars in Sociology.

Major and Minor Areas of Specialization

In addition to the specific requirements common to all Ph.D. students, students must complete courses in which they acquire competence in a major and a minor area of specialization. The major and minor should be chosen by the student in consultation with the Ph.D. committee. A record of the chosen areas must be filed with and approved by the graduate officer. The major area may be selected from the department's primary Ph.D. program strengths:

1. demography (including health and immigration),
2. family, life course, and aging,
3. criminology,
4. stratification and inequality,
5. sociology of education,
6. urban and community studies, and
7. quantitative methods.

Alternatively, students may develop their own customized areas that have included in recent years (but are not restricted to): race and ethnicity, social theory, sociology of organizations, sociology of religion, and collective behavior and social movements. Each student, no matter their choice of specialty areas, in consultation with the Ph.D. committee develops a program of course work necessary for preparation of the major and minor areas.

At least 12 credits of course work are associated with the major area of specialization. Course work is subject to the following constraints:

1. at least three courses must be listed in the sociology department;
2. at least two courses must be in formal 500-level seminars;
3. no more than one course may be in SOC 596.

The minor area of specialization is developed in the same manner, in consultation with the Ph.D. committee and with the approval of the Graduate Officer and the graduate committee. Students are required to take at least 9 credits of course work in the area selected as their minor. Earlier-named specific course requirements, such as seminars in statistics, research methods, and theory, cannot be used to meet the nine-credit minimum for the minor area. The minor course requirements also are subject to the following constraints:

1. at least two courses must be in sociology;
2. at least one course must be in 500-level seminars.

One course may be double-counted in the major and minor areas.

Comprehensive Examination

After completing all course work and before the period of intensive dissertation research begins, doctoral students must pass a comprehensive examination that includes written and oral components. Written components will be administered in a candidate's major and minor areas of concentration. Members of the Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination. The oral component of the comprehensive involves the defense of a dissertation prospectus.

Dissertation and Dissertation Defense

To earn the Ph.D. degree, doctoral students must also write a dissertation that contains original research and reflects their education in sociology. Upon completion of the doctoral dissertation, the candidate also must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

The Department of Sociology has no formal foreign language or communication requirement. However, students are encouraged to pursue additional training in statistics, computer science, foreign language, technical writing, specialized methods, or specialized theory that will further dissertation and career plans.

Dual-Titles

Dual-Title M.A. and Ph.D. in Sociology and Demography

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Students must apply and be admitted to the graduate program in Sociology and the Graduate School before they can be admitted to a dual-title degree program. Applicants interested in the dual-title degree program may note their interest in their applications to Sociology and include remarks in their personal statements, in which they address the ways in which their research and professional goals in sociology reflect related interests in Demographic research. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Demography dual-title program. Refer to

the Admission Requirements section of the Demography Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/demography/>). Students admitted to the Sociology program will be admitted to the dual-title program in Demography upon the recommendation of a Demography Program faculty member in Sociology. Ph.D. students must apply and be admitted to the dual-title degree program in Demography prior to taking the qualifying exam.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Sociology. In addition, students must complete the degree requirements for the dual-title in Demography, listed on the Demography Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/demography/>).

Degree Requirements for the Dual-Title M.A.

Dual-title M.A. students must complete four courses in demography, one in each of the following pedagogic categories:

1. Demography Survey Course (if a population survey course was not completed as an undergraduate),
2. Demographic Methods Course,
3. Seminar in Demographic Processes, and
4. Population Studies Seminar.

Multiple courses are offered in each of these categories each year, and many of the courses can be taken within the sociology department and counted toward sociology degree requirements. Dual-title M.A. students must write a thesis on a topic that draws on research questions and literature from both sociology and demography.

Degree Requirements for the Dual-Title Ph.D.

Students pursuing the dual-title Ph.D. in Sociology and Demography select demography as their major area of specialization. However, dual-title students must complete a total of 24 course credits (12 credits, or 4 courses, at the M.A. plus 12 additional credits distributed among pedagogic categories) in demography. Some of these courses must be completed in disciplines outside the Department of Sociology. All demography courses taken within the sociology department can count toward both the sociology and demography degrees.

Qualifying Examination Committee and Exam

The qualifying examination committee will be composed in accordance with rules of the Sociology Ph.D. and will include an evaluation of at least one Graduate Faculty member from the Demography Program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role.

The dual-title degree will be guided by the qualifying exam procedure of the Sociology graduate program. The qualifying exam for the dual-title degree will occur as soon as possible after completion of the M.A. requirements. There will be a single qualifying examination to assess both Sociology and Demography. Because students must first be admitted to a graduate major program of study before they may apply to and be considered for admission into a dual-title graduate degree program, dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

Ph.D. committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D.

committee of a Sociology and Demography dual-title Ph.D. student must include at least two members of the Demography Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the committee representing Sociology is not also a member of the Graduate Faculty in Demography, one member of the committee representing Demography must be appointed as co-chair.

Comprehensive Exam

After completing all course work, doctoral students in the dual-title doctoral degree program in Sociology and Demography must pass a comprehensive examination that includes written and oral components. Written components will be administered in a candidate's major sociology area of concentration in Demography and the chosen minor area. The Demography representative(s) on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination. The oral component of the comprehensive involves the defense of a dissertation prospectus, which must contain substantial Demographic content.

Dissertation and Dissertation Defense

Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. Students enrolled in the dual-title program are required to write and orally defend a dissertation on a topic that reflects their original research and education in Sociology and Demography. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title Ph.D. in Sociology and Social Data Analytics

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Sociology doctoral students seeking to attain and be identified with an interdisciplinary array of tools, techniques, and methodologies for social data analytics, while maintaining a close association with sociology, may apply to pursue a dual-title Ph.D. in Sociology and Social Data Analytics.

Social data analytics is the integration of social scientific, computational, informational, statistical, and visual analytic approaches to the analysis of large or complex data that arise from human interaction. The dual-title Ph.D. program provides additional training with the aim of providing scientists with the skills required to expand the field of social data analytics, creatively to answer important social scientific questions, and communicate effectively with both academic and nonacademic audiences.

Admission Requirements

Students must apply and be admitted to the graduate program in Sociology and the Graduate School before they can apply for admission to the dual-title degree program. Applicants interested in the dual-title degree program may note their interest in the program on their applications to Sociology and include remarks in their personal statements, in which they address the ways in which their research and professional goals in sociology reflect related interests in Social Data Analytics-related research.

After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Social Data Analytics dual-title program. Refer to the Admission

Requirements section of the Social Data Analytics Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/social-data-analytics/>).

To be enrolled in the dual-title doctoral degree program in Social Data Analytics, a student must submit a letter of application and transcript, which will be reviewed by the Social Data Analytics Admissions Committee. An applicant must have a minimum grade point average of 3.0 (on a 4-point scale) to be considered for enrollment in the dual-title degree program. Students must be admitted into the dual-title degree program in Social Data Analytics no later than the end of the fourth semester (not counting summer semesters) of entry into the primary Ph.D. program and before taking the comprehensive exam.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the requirements of the Ph.D. in Sociology. In addition, students must complete the degree requirements for the dual-title in Social Data Analytics, listed on the Social Data Analytics Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/social-data-analytics/>). Within this framework, final course selection is determined by the student in consultation with academic advisers from their home department adviser and Social Data Analytics.

The minimum course work requirements for the dual-title Ph.D. in Sociology and Social Data Analytics are as follows:

- Course work and other requirements of the Ph.D. in Sociology.
- SODA 501 (3 credits)
- SODA 502 (3 credits)
- 12 or more elective credits in Social Data Analytics from a list of courses maintained by the Social Data Analytics Committee. Collectively the elective credits must satisfy the following requirements:
 - (A) Core analytics distribution. 3 or more credits in courses focused on statistical learning, machine learning, data mining, or visual analytics. Courses approved as meeting this requirement are designated (A) on the list of approved electives.
 - (Q) Quantification distribution. 6 or more credits in courses focused on statistical inference or quantitative social science methodology. Courses approved as meeting this requirement are designated (Q) on the list of approved electives. (*A Sociology Ph.D. student would typically satisfy this distribution requirement as a function of completing the requirements of the Sociology Ph.D.*)
 - (C) Computational / informational distribution. 6 or more credits in courses focused on computation, collection, management, processing, or interaction with electronic data, especially at scale. Courses approved as meeting this requirement are designated (C) on the list of approved electives.
 - (S) Social distribution. 6 or more credits in courses with substantial content on the nature of human interaction and/or the analysis of data derived from human interaction and/or the social context or ethics or social consequences of social data analytics. Courses approved as meeting this requirement are designated (S) on the list of approved electives. (*A Sociology Ph.D. student would typically satisfy this distribution requirement as a function of completing the requirements of the Sociology Ph.D.*)
 - Cross-departmental distribution.
 - 3 or more credits in approved courses with the prefix STAT or that of a primarily social science department. (*A Sociology student would typically satisfy this distribution requirement as a function of completing the requirements of the Sociology Ph.D.*)

- 3 or more credits in approved courses with the prefix IST, GEOG, or that of a primarily computer science or engineering department.
- 6 or more credits in approved courses outside Sociology.
- 3 or fewer credits in approved courses at the 400-level.

Students or faculty may request that the Social Data Analytics Committee consider approval of elective designations for any course, including temporary approvals for experimental or variable-title courses. Students are encouraged to take interdisciplinary courses that carry multiple (A), (Q), (C), (S) designations, as well as to select SODA electives that also meet requirements of the primary program. In particular, the 12 elective credits can be met with as few as 6 credits of appropriately chosen course work. Within this framework, final course selection is determined by the student in consultation with academic advisers from Sociology and Social Data Analytics. There is no formal maximum number of credits from the primary SOC degree that can be double-counted toward the SODA degree. For those meeting the SODA elective requirement with the minimum of 12 credits, the outside-program minimum effectively limits the number of primary degree SOC credits that count toward SODA at 6. Ph.D. committees may limit the number of credits taken for the SODA degree that can count toward the primary graduate program degree requirements.

Qualifying Exam

The qualifying examination in Sociology satisfies the qualifying exam requirement for the dual-title degree program in Social Data Analytics.

Ph.D. committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Sociology and Social Data Analytics dual-title doctoral degree student must include at least one member of the Social Data Analytics Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the committee representing Sociology is not also a member of the Graduate Faculty in Social Data Analytics, the member of the committee representing Social Data Analytics must be appointed as co-chair.

Comprehensive Exam

After completing all course work, doctoral students in the dual-title doctoral degree program in Sociology and Social Data Analytics must pass a comprehensive examination that includes written and oral components.

Written components will be administered in the student's major sociology area of concentration and Social Data Analytics (acting as the minor area). The Social Data Analytics representative(s) on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

The oral component of the comprehensive involves the defense of a dissertation prospectus, which must contain substantial Social Data Analytics content.

Dissertation and Dissertation Defense

Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. Students enrolled in the dual-title program are required to write and orally defend a dissertation on a topic that reflects their original research and education in Sociology and Social Data Analytics. The dissertation must

be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Teaching assistantships support many students admitted to the program. Research assistantships also are available to qualified students through individual faculty members' grants and contracts. A number of federal agencies also offer fellowships for graduate study in sociology.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Sociology (SOC) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/soc/>)

Learning Outcomes

Master of ArtS (M.A.)

1. KNOW: Graduates will be able to demonstrate conceptual understanding of theoretical concepts, proficiency in quantitative analysis for continuous and discrete outcomes and predictors, and understanding of sociological approaches to a major substantive area at the level required to contribute to the discipline of sociology.

2. **KNOW:** Graduates will be able to demonstrate conceptual understanding of the ethical practice of research and research protections.
3. **CRITICAL THINKING:** Graduates will be able to critically conceptualize and define the sociological aspects of a problem as part of sociological research.
4. **CRITICAL THINKING:** Graduates will be able to critically analyze both strengths and weaknesses of competing sociological arguments at the level required to contribute to the discipline of sociology.
5. **RESEARCH:** Graduates will demonstrate the ability to design and execute a research strategy appropriate to answering a significant question having real-world applications in the field of sociology.
6. **COMMUNICATE:** Graduates will be able to effectively communicate a sociological argument, research design, analytic strategy, findings, and conclusions in formal presentations and in written works to scholars in the field as well as students at different levels.
7. **PROFESSIONAL PRACTICE:** Graduates will demonstrate a commitment to active citizenship in the discipline, including engagement in service to the profession and society at large.
8. **PROFESSIONAL PRACTICE:** Graduates will demonstrate a strict adherence to the ethical practice of research and professional honesty.

Doctor of Philosophy (Ph.D.)

1. **Know:** Students will demonstrate an understanding of major sociological theories, concepts, research designs, and analysis strategies appropriate to their MAJOR and MINOR areas of specialization.
2. **Apply/Create:** Students will demonstrate an ability to evaluate and critique empirical research and theoretical approaches in their MAJOR area of specialization; identify questions and testable hypotheses that will make a contribution to the literature in their MAJOR area of specialization; and formulate their own arguments based on integrating the literature in their MAJOR area of specialization.
3. **Communication:** Students will demonstrate an ability to communicate (in oral and written form) effectively to scholarly and student audiences; argue persuasively their positions; and contribute to the discipline through clearly written, well-organized manuscripts, proposals, and formal presentations.
4. **Research Skills:** Students will demonstrate an ability to devise a research design, conduct an analysis, and interpret results appropriate to the argument being made and the hypotheses being tested.
5. **Professional Practice.** Students will demonstrate an awareness of professional norms and rules of civility in their personal interactions and communication; awareness of and compliance with the ethical practice of research; and awareness of and compliance with expectations of good citizenship in the organizations with which they are associated.

Contact

Campus	University Park
Graduate Program Head	Michelle Lynn Frisco
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Scott Thomas Yabiku
Program Contact	Sierra Brooke Waite 213 Oswald Tower University Park PA 16802 sbw5348@psu.edu (814) 865-3455
Program Website	View (http://sociology.la.psu.edu/)

Software Engineering

Graduate Program Head	Raghu Sangwan
Program Code	SWENG
Campus(es)	Great Valley (M.S.E.) World Campus (M.S.E.)
Degrees Conferred	Master of Software Engineering (M.S.E.) Integrated B.S. in Computer Science and M.S.E. in Software Engineering
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=SWENG)

The Master of Software Engineering program at Penn State Great Valley prepares computer professionals to develop software products and services for industry and government through software analysis, design and architecture; system verification; data storage and retrieval; and managing globally distributed development. This program is STEM designated.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Admission to the Master of Software Engineering program will be based on baccalaureate academic records, applicable work experience, and two letters of recommendation from a previous professor or supervisor who can attest to the applicant's academic potential. Applicants with an undergraduate degree in software engineering, computer science, information systems, or similar quantitative disciplines such as science or engineering may apply. Students from other disciplines will be considered based on prior course work and/or standardized test scores. Normal admission requirements include background in operating systems, programming languages, data structures and algorithm analysis. Applications must include a statement of professional goals and a curriculum vitae or resume. Test scores from the GMAT or GRE exams are not required. An undergraduate cumulative grade-point average of 3.0 or better on a 4.0 scale is required prior to admission to the IUG program.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/>)

gcac-300/gcac-305-admission-requirements-international-students/) for more information.

Degree Requirements

Master of Software Engineering (M.S.E.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The Master of Software Engineering degree is conferred upon students who earn a minimum of 36 credits of course work while maintaining an average grade-point average of 3.0 or better in all course work, including at least 18 credits at the 500 or 800 level (with at least 6 credits at the 500 level). The program curriculum includes 18 credits of core courses, 12 credits of electives, and 6 credits of capstone experience.

Code	Title	Credits
Required Courses		
SWENG 505	Software Project Management	3
SWENG 581	Software Testing	3
SWENG 586	Requirements Engineering	3
SWENG 587	Software Systems Architecture	3
SWENG 837	Software System Design	3
SWENG 861	Software Construction	3
Electives		
An additional 12 credits of elective courses must be selected from a list of approved elective courses maintained by the graduate program office.		12
Culminating Experience		
SWENG 894	Capstone Experience	6
Total Credits		36

All students will complete their program of study with a capstone project that provides students with an opportunity to apply their knowledge of the software engineering theories, methods, processes, and tools learned throughout their program, in a culminating and summative experience. Students complete the capstone project while enrolled in SWENG 894.

Integrated Undergrad-Grad Programs

Integrated B.S. in Computer Science and M.S.E. in Software Engineering

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Computer Science with the M.S.E. in Software Engineering offered at the following campuses:

Undergraduate Degree

- Abington
- Capital

Graduate Degree

- Great Valley
- World Campus

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/>

gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/).

This Integrated Undergraduate Graduate (IUG) degree program will combine the Master of Software Engineering at the Penn State Great Valley, School of Professional Graduate Studies, with the Bachelor of Science in Computer Science at Penn State Abington into a seamless five-year B.S. to Master's degree program. The IUG concluding in a Master of Software Engineering degree prepares computer professionals to develop software products and services for industry and government through software analysis, design and architecture; system verification; data storage and retrieval; and managing globally distributed development. This program is STEM designated.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<http://gradschool.psu.edu/graduate-education-policies/>).

Students must apply to the program via the Graduate School application for admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet all the admission requirements of the Graduate School. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.

Admission to the IUG Master of Software Engineering program will be based on baccalaureate academic records, applicable work experience, and one CMPSCI faculty recommendation who can attest to the applicant's academic potential. Normal admission requirements include background in operating systems, programming languages, data structures and algorithm analysis. Applications must include a statement of professional goals and a curriculum vitae or resume. Test scores from the GMAT or GRE exams are not required. An undergraduate cumulative grade-point average of 3.0 or better on a 4.0 scale is required prior to admission to the IUG program.

In consultation with an adviser, students must prepare a plan of study appropriate to this integrated program, and must present their plan of study to the head of the graduate program or the appropriate committee overseeing the integrated program prior to being admitted to the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.

Degree Requirements

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.S. in Computer Science are listed in the Undergraduate Bulletin. Degree requirements for the M.S.E. degree are listed on the Degree Requirements tab.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted credits must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted. IUG students must meet

the Graduate School's GPA requirements and maintain a 3.5 GPA in the double counted courses for successful completion of the degree.

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
CMPSC 430	Database Design	3
CMPSC 487W	Software Engineering and Design	3
SWENG 581	Software Testing	3
SWENG 837	Software System Design	3

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.S.E. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Refer to the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students in this program are not eligible for graduate assistantships.

Financial aid for students in on-campus programs is in the form of student loans and a limited number of small scholarships, as described on the Penn State Great Valley website (<https://greatvalley.psu.edu/tuition-and-financial-aid/>).

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Software Engineering (SWENG) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/sweng/>)

Learning Outcomes

1. **KNOW.** Graduates will be able to demonstrate mastery of concepts and methods for modeling, designing, developing and testing software solutions using legacy and contemporary environments.
2. **CRITICAL THINKING.** Graduates will be able to critically and creatively plan and manage development of software intensive systems using project management methods and tools.
3. **PROBLEM SOLVING.** Graduates will be able to demonstrate proficiency in exploring the trade space within a given set of internal and external constraints for a system under development.
4. **COMMUNICATE.** Graduates will be able to effectively communicate their ideas within their organization, to other practicing professionals and the general public.
5. **TEAMWORK.** Graduates will be able to work collaboratively within and with project teams including those that are geographically distributed.

Contact

Campus	Great Valley
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Raghu Sangwan
Program Contact	MICHELLE WHALEN Penn State Great Valley 30 East Swedesford Road Malvern PA 19355 mmw6441@psu.edu
Program Website	View (http://greatvalley.psu.edu/academics/masters-degrees/software-engineering/)

Campus	World Campus
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Raghu Sangwan
Program Contact	MICHELLE WHALEN Penn State Great Valley 30 East Swedesford Road Malvern PA 19355 mmw6441@psu.edu
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/software-engineering-masters/overview/)

Soil Science

Graduate Program Head	Margot Kaye
Program Code	SOILS
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Dual-Title Ph.D. in Soil Science and Biogeochemistry Dual-Title Ph.D. and M.S. in Soil Science and International Agriculture and Development Dual-Title Ph.D. and M.S. in Soil Science and Transdisciplinary Research on Environment and Society
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=SOILS)

The Soil Science program is administered in the Department of Ecosystem Science and Management, College of Agricultural Sciences. Each student will be associated with an adviser who may provide financial support, research facilities, and/or office space. Applicants are encouraged to explore, study, and research opportunities by contacting faculty who may be prospective advisers.

This program provides opportunities for candidates interested in soil and related water resources to become a professional leader and an independent scholar. Faculty in this program are competent to prepare candidates in the subfields of Soil Science including:

- soil genesis,
- soil classification,
- soil morphology,
- soil mapping,
- soil physics,
- soil chemistry,
- soil health,
- soil mineralogy,
- soil microbiology,
- soil fertility,
- soil conservation,
- geographic information systems,
- computer mapping,
- watershed analysis,
- soil hydrology,
- soil and water management,
- resource inventory and assessment,
- remote sensing,
- land evaluation,
- land waste disposal, and
- land management.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate->

[admissions/how-to-apply/](https://gradschool.psu.edu/graduate-education-policies/)). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Prerequisites for major work in Soil Science vary with the area of specialization and the degree sought, but courses in chemistry, mathematics, physics, geology, and basic and applied biological sciences are required.

Applicants for the M.S. degree must have a baccalaureate degree including 76 credits of basic and applied natural sciences. Admission to the Ph.D. program usually requires an M.S. or equivalent degree with a minimum cumulative grade-point average of 3.25 (on a 4.00 scale). Applicants for the Ph.D. program will be evaluated on the quality of work completed in all previous degree programs. Students who lack some of the prerequisite courses may be admitted at the discretion of the faculty member who will serve as the student's adviser. The best-qualified applicants will be accepted up to the number of spaces available for new students. Generally students are not admitted into the program without a faculty member agreeing to serve as the adviser. Credits for prerequisite courses cannot be applied towards requirements for the degree.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A minimum of 30 credits at the 400, 500, 600, or 800 level is required, with least 18 credits at the 500 and 600 level, combined. The department requires 12 credits of 400- or 500-level formal courses in Soil Science of which 6 must be 500-level, and 6 credits of 400- or 500-level courses in a minor or general studies area. A total of 6 credits, with at least 3 credits at the 500 level, must be taken in statistics. Participation in at least one colloquium course each semester is expected and students must complete at least 1 credit of colloquium (SOILS 590). In addition, M.S. students are required to complete 1 credit of Supervised Experience in College Teaching (SOILS 602); however, this 1 credit cannot be counted towards the degree requirements. Specific courses and requirements will be determined by the faculty adviser and advisory committee.

A thesis based on field or laboratory research is required for the M.S. degree and at least 6 credits in thesis research (SOILS 600 or SOILS 610) must be taken in conjunction with completing the thesis. The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School, and the student must pass a thesis defense.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

While a minimum number of courses for the degree is not specified, the Ph.D. committee has the responsibility of specifying courses and credits essential for the education and development of the student. Students are expected to be educated in depth in a specific subfield of Soil Science and to have a perspective of the general field. Normally, students will have 50 to 60 credits in formal course work beyond the B.S. degree. A minimum of 12 credits of 500-level courses beyond the baccalaureate degree are required. Additional requirements include a minimum of 15 credits of 400- or 500-level courses in a minor or general studies area, 6

credits of statistical methods beyond the baccalaureate degree, of which a minimum of 3 will be at the 500 level, and 12 credits of SOILS 600 or SOILS 610.

Doctoral students are required to participate regularly in a departmental colloquium and to register for at least 1 credit of Colloquium (SOILS 590) during the Ph.D. program. Ph.D. students are required to complete two separate semesters of Supervised Experience in College Teaching (SOILS 602) for 2 credits total; however, these 2 credits cannot be counted towards the degree requirements. Doctoral students must pass a qualifying examination, a comprehensive written and oral examination, and a final oral examination (the dissertation defense). To earn the Ph.D. degree, doctoral students must also write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Titles

Dual-Title Ph.D. in Soil Science and Biogeochemistry

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Doctoral students with research and educational experiences in soil science may apply to the Soil Science/Biogeochemistry dual-title doctoral degree program. The goal of the dual-title Ph.D. degree in Soil Science and Biogeochemistry is to enable SOILS graduate students to acquire the knowledge and skills of their major area of specialization in SOILS, while at the same time gaining expertise and skills in biogeochemistry. Graduate study in this program seeks to provide students with the intellectual foundation for integrated and mechanistic understanding of interactions between microbes, soils, and plants in diverse environmental systems. Interdisciplinary training that includes biogeochemistry will prepare students for positions in academia, government, non-profit organizations, and the private sector. It will also prepare students for a wide array of research careers in the private sector, including agricultural and environmental sciences, energy industries, and the integrated study of the sustainability of biological systems.

Admission Requirements

For admission to the dual-title doctoral degree in Biogeochemistry, a student must first apply and be admitted to the Soil Science graduate program and The Graduate School. It is preferable but not necessary to discuss the dual-title interest beforehand with a major adviser who has been appointed to the Biogeochemistry program. Refer to the Admission Requirements section of the Biogeochemistry Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/biogeochemistry/>). After admission to the Soil Science program, students must apply for admission to the Biogeochemistry dual-title program by submitting an application to the Biogeochemistry Graduate Program Coordinator. The application consists of a written personal statement describing the student's biogeochemistry research interests and career goals that can be met by earning a dual-title SOILS/BGC degree. The statement should be signed by the student's major adviser in support of the student's taking on the academic responsibilities of the dual-title degree. The application will be reviewed by the BGC Program Coordinator, in consultation with the BGC Executive Committee, who will make the admission decision and notify the Graduate School. Students must be admitted into the BGC program prior to taking the qualifying exam.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the Soil Science Ph.D. degree requirements. In addition, students pursuing the dual-title Ph.D. in Soil Science and Biogeochemistry must complete the degree requirements for the dual-title Biogeochemistry Ph.D., listed on the Biogeochemistry Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/biogeochemistry/>). Students are required to have two advisers from separate disciplines: one individual serving as a primary adviser in their major degree program and a secondary adviser in an area within a field covered by the dual-title program who is a member of the Biogeochemistry Graduate Faculty. The major program adviser normally will also be a member of the Biogeochemistry Graduate Faculty. The two faculty advisers can represent different academic programs, but this is not required, as faculty from a scientifically diverse department could represent very different areas of expertise.

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Soil Science and must include at least one Graduate Faculty member from the Biogeochemistry program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Soil Science and Biogeochemistry. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Soil Science and Biogeochemistry dual-title doctoral degree student must include at least one member of the Biogeochemistry Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Biogeochemistry, the member of the committee representing Biogeochemistry must be appointed as co-chair. The Biogeochemistry representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students enrolled in the dual-title program are required to write and orally defend a dissertation on a topic that reflects their original research and education in Soil Science and Biogeochemistry. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title M.S. and Ph.D. in Soil Science and International Agriculture and Development

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Graduate students with research and educational interests in international education may apply to the Soil Science/INTAD Dual-Title Degree Program. The goal of the dual-title degree in Soil Science and INTAD is to enable graduate students from Soil Science to acquire the knowledge and skills of their primary area of specialization in Soil Science, while at the same time gaining the perspective and methods needed for work in the international agriculture. Graduate study in this program seeks to prepare students to assume leadership roles in science,

science education, outreach, and project management anywhere in the world. Students are required to write research proposals and expected to write grants to support their research activities, reflecting the dual-title degree. As part of their professional development presentations, publication of research articles and active participation in professional societies is expected. Emphasis is placed upon the professional development of the student. Students are able to specialize in the research program areas of soil genesis, classification, morphology, mapping, microbiology, chemistry, physics, mineralogy, fertility, geographic information systems, remote sensing, watershed analysis, hydrology, and land management. At the same time they will acquire a broad perspective about how to apply their research findings in the context of the broader international community. Thus, the dual-title will allow students to master their field of specialization from an international perspective so that they can compare practices and outcomes between countries and regions.

Admission Requirements

For admission to the dual-title graduate degree under this program, a student must first apply and be admitted to the Soil Science graduate program. Once accepted into the Soil Science program, the student can then submit an application to the INTAD Academic Program Committee for the dual-title degree program. Refer to the Admission Requirements section of the INTAD Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/international-agriculture-development/>). The application consists of an application form, a written personal statement indicating the career goals that a student hopes to accomplish by earning a dual-title SOILS/INTAD degree, and a letter from the Soil Science academic adviser supporting the student's taking on additional academic responsibilities. The letter also must confirm that the student is in good standing and is capable of taking on the dual-title degree. The application will be reviewed by the INTAD Academic Program Committee, which will make all final admission decisions. Doctoral students must be admitted into the INTAD program prior to taking the qualifying exam.

Degree Requirements for the Dual-title M.S.

To qualify for this dual-title degree, students must satisfy the requirements of the Soil Science Master of Science degree program. In addition, they must satisfy the INTAD program requirements for the dual-title master's degree. Refer to the Master's Degree Requirements section of the INTAD Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/international-agriculture-development/>). Some courses may satisfy both the primary graduate program requirements and those of the INTAD program. The double counting of credits must be approved by the student's adviser(s), the head of the SOILS graduate program, and the INTAD Co-Chairs.

For the dual-title M.S. degree in Soil Science and INTAD, the thesis must reflect the student's education and interest in both Soil Science and INTAD. All members of the student's committee must be members of the Graduate Faculty. The master's committee must include at least one Graduate Faculty member from INTAD. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role.

Degree Requirements for the Dual-Title Ph.D.

To qualify for the dual-title degree, students must satisfy the degree requirements for the Ph.D. in Soil Science. In addition, students must complete the degree requirements for the dual-title in INTAD, listed on the INTAD Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/international-agriculture-development/>). Some courses may satisfy both Soil Science and INTAD degree requirements. The double

counting of credits must be approved by the student's adviser(s), the head of the SOILS graduate program, and the INTAD Co-Chairs.

Graduates of the dual-title INTAD master's degree program who wish to pursue an INTAD doctoral degree must re-apply to the INTAD program for admission. INTAD master's degree credits may be carried over to the doctoral program. Six additional INTAD credits will be required. INTAD master's degree graduates who pursue an INTAD Ph.D. are required to take the INTAD 820 International Agricultural Development Seminar a second time.

Qualifying Examination

Qualifying examination procedures will be based on the procedures of the Soil Science graduate degree program, but will integrate the fields of Soil Science and International Agriculture and Development. Although not encouraged, the dual-title degree student may require an additional semester or more to fulfill requirements for the dual-title degree program. Therefore, under exceptional circumstances, the qualifying exam may be delayed at the discretion of the student's Soil Science adviser in consultation with the INTAD program coordinators. The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Soil Science and must include at least one Graduate Faculty member from INTAD.

Committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Soil Science and INTAD dual-title Ph.D. student must include at least one member of the INTAD Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in INTAD, the member of the committee representing INTAD must be appointed as co-chair.

Comprehensive Exam

At the end of the course work, students in the dual-title doctoral degree program in Soil Science and INTAD will be required to pass an oral and written comprehensive examination based on their dissertation proposal and area of specialization in Soil Science, while reflecting their dual-title curriculum. A separate comprehensive examination is not required by the INTAD program, but international agriculture must be one of the key areas of the comprehensive exam and the INTAD representative on the student's Ph.D. committee must have input into the development of and participate in the evaluation of the comprehensive examination.

Dissertation and Dissertation Defense

Ph.D. students enrolled in the dual-title degree program are required to write and orally defend a dissertation on a topic that reflects the integration of their original research and education in Soil Science and International Agriculture and Development. In order to satisfy the INTAD dissertation requirement, students may: 1) conduct all or part of their research in an international location, 2) conduct an analysis of a subject in an international context, 3) conduct an analysis of secondary data of international origin, or 4) incorporate another international dimension by approval of the INTAD committee member. Additionally, the dissertation should reflect the student's technical knowledge, knowledge of and sensitivity to a wide diversity of cultures and backgrounds, and the perspective needed to transfer their knowledge in other cultures, particularly in the developing world. The dissertation should contribute to the body of knowledge in soil science and global agricultural development and have potential application in both U.S and international contexts. A public oral presentation of the dissertation is

required. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title M.S. and Ph.D. in Soil Science and TRANSDISCIPLINARY RESEARCH ON ENVIRONMENT AND SOCIETY

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

M.S. and Ph.D. students with research and educational interests in contemporary natural resource and societal changes may apply to the dual-title program in Soil Science (SOILS) and Transdisciplinary Research on Environment and Society (TREES).

The goal of the dual-title graduate program is to enable graduate students from SOILS to acquire the knowledge and skills of their primary area of specialization in SOILS, while at the same time gaining experience in creating engaged approaches to transdisciplinary scholarship. Graduate study in this program seeks to prepare students to draw upon materials from the soil and/or water, sociocultural, and sociodemographic arenas in an integrated, collaborative framework. Graduates of the TREES program are equipped with the ability to communicate effectively with stakeholders affected by natural resource and environmental change issues in public settings. Students are required to write research proposals for collaboration and are expected to write grants to support their transdisciplinary research activities reflecting both research areas of the dual-title degree. As part of their professional development presentations, publication of research articles and active participation in professional societies is expected. Emphasis is placed upon the professional development of the student.

ADMISSION REQUIREMENTS

Students must apply and be admitted to the graduate program in SOILS and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the TREES dual-title program. Refer to the Admission Requirements section of the TREES Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/transdisciplinary-research-environment-society/>). Doctoral students must be admitted into the dual-title degree program in TREES prior to taking the qualifying examination in their primary graduate program.

DEGREE REQUIREMENTS FOR THE DUAL-TITLE M.S.

To qualify for this dual-title degree, students must satisfy the requirements of the SOILS Master of Science degree program, listed on the Degree Requirements tab. In addition, they must satisfy the TREES program requirements for the dual-title master's degree. Refer to the Master's Degree Requirements section of the TREES Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/transdisciplinary-research-environment-society/>). Some courses may satisfy both the graduate primary program requirements and those of the TREES program. Final course selection is determined by the student after consulting, in advance, with their SOILS and TREES advisers.

For the dual-title M.S. degree in SOILS and TREES, the thesis must reflect the student's education and interest in both SOILS and TREES. All

members of the student's committee must be members of the Graduate Faculty. The thesis supervisor and chair of the student's committee shall be a member of SOILS and TREES. Upon selection of the committee members, the committee should be officially appointed via the current outlined process from the Graduate School and must be approved by the TREES Academic Program Committee Co-chair.

DEGREE REQUIREMENTS FOR THE DUAL-TITLE PH.D.

To qualify for the dual-title degree, students must satisfy the degree requirements for the Ph.D. in SOILS, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual-title in TREES, listed on the TREES Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/transdisciplinary-research-environment-society/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from SOILS and must include at least one Graduate Faculty member from the TREES program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both SOILS and TREES. The qualifying examination for SOILS will satisfy the qualifying exam requirement for the dual-title degree program in TREES. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of an SOILS and TREES dual-title Ph.D. student must include at least one member of the TREES Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in TREES, the member of the committee representing TREES must be appointed as co-chair. The TREES representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in SOILS and TREES. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Soil Science (SOILS) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/soils/>)

Learning Outcomes

Master of Science (M.S.)

1. **KNOW:** Graduates in these three masters programs will have obtained knowledge of core theories and methods as demonstrated by courses completed and grades earned at the bachelor's level. Graduates will exhibit breadth and depth of understanding in their respective disciplines in courses completed at the master's level.
2. **APPLY/CREATE:** Graduates in these three masters programs will be able to clearly synthesize literature and theories in their disciplinary areas and/or in their specialized thesis topics. Such synthesis will help generate new ideas or methods to develop unique solutions to the problems in the three disciplinary programs.
3. **COMMUNICATE:** Graduates in these three masters programs will effectively communicate ideas, arguments, and rationales in clear, concise, well-organized publications (abstracts, papers, proposals) and presentations (conferences, seminars, and research meetings).
4. **THINK:** Graduates in these three masters programs will be able to critically analyze the work of others in their field of specialty. Such analyses will help graduate students to demonstrate proficiency in designing a research strategy to answer important questions and to improve their own work.
5. **PROF. PRACTICE:** Graduates in these three masters programs will demonstrate the highest ethical standards and core values (including

Penn State Core Values) within their discipline and other diverse scientific backgrounds.

Doctor of Philosophy (Ph.D.)

1. **KNOW:** Graduates in these three doctoral programs will have obtained the knowledge of the core theories and methods at the bachelors and/or master's levels. Graduates will exhibit breadth and depth of understanding in their respective disciplines in courses completed at the doctoral level.
2. **APPLY/CREATE:** Graduates in these three doctoral programs will be able to clearly synthesize literature and theories in their disciplinary areas and/or in their specialized thesis/dissertation topics. Such synthesis will help generate new ideas or methods to develop unique solutions to the problems in the three disciplinary doctoral programs.
3. **COMMUNICATE:** Graduates in these three doctoral programs will effectively communicate ideas, arguments, and rationales in clear, concise, well-organized publications (abstracts, papers, proposals) and presentations (conferences, seminars, and research meetings).
4. **THINK:** Graduates in these three doctoral programs will be able to critically analyze the work of others in their field of specialty. Such analyses will help graduate students to demonstrate proficiency in designing a research strategy to answer important questions and to improve their own work.
5. **PROF. PRACTICE:** Graduate students in these three doctoral programs will demonstrate the highest ethical standards and core values (including Penn State Core Values) within their discipline and other diverse scientific backgrounds.

Contact

Campus	University Park
Graduate Program Head	Margot Wilkinson Kaye
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Patrick Joseph Drohan
Program Contact	Nicole Marie Houck Dept of Ecosystem Sci Mngmt 319 Forest Resources Building University Park PA 16802 nmh5631@psu.edu (814) 863-7221 View (http://ecosystems.psu.edu/)
Program Website	

Spanish

Graduate Program Head	Paola Dussias
Program Code	SPAN
Campus(es)	University Park (Ph.D., M.A.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Arts (M.A.) Dual-Title Ph.D. in Spanish and Language Science Dual-Title Ph.D. in Spanish and Visual Studies View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=SPAN)
The Graduate Faculty	

The Spanish program offers an option in Applied Linguistics for the M.A. and Ph.D. degrees, and an emphasis in literature and linguistics for the M.A. and Ph.D. degrees.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The minimum requirement for admission normally will be the equivalent of an undergraduate Spanish major.

Applicants must submit a statement of purpose and a single-authored sample of representative research. One of these must be in Spanish and one in English.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of Arts (M.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A candidate for the M.A. degree must take a minimum of 30 credits at the 400, 500, or 800 level, with at least 18 credits in 500-level courses. Required courses for the M.A. degree are SPAN 502 (1 credit) and PORT 123 (2 credits). Students are required to take PORT 123 in order to achieve basic proficiency in Portuguese; however, as a 100-level undergraduate course, PORT 123 will not count towards the 30 minimum credits required for the degree and will not count in the cumulative GPA.

The culminating experience for the M.A. degree is a scholarly essay. A cumulative examination is also required, which serves as the doctoral qualifying examination for students continuing in the Ph.D. program. The M.A. degree (or equivalent) is normally a prerequisite for entrance to the Ph.D. program.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

For the Ph.D. degree, a student must complete at least 51 credits (including M.A. credits) of course work at the 400, 500, 600, or 800-level. Other requirements include reading knowledge of a language other than English and Spanish and submission of an essay to a peer-reviewed journal. Doctoral students must pass a qualifying examination, a comprehensive written and oral examination, and a final oral examination (the dissertation defense). To earn the Ph.D. degree, doctoral students must also write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Titles

Dual-Title Ph.D. in Spanish and Language Science

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Graduate students with research and educational interests in Spanish may apply to the Spanish and Language Science dual-title degree program. The goal of the dual-title in Spanish and Language Science is to enable graduate students from Spanish to acquire the knowledge and skills of their major area of specialization in Linguistics while at the same time gaining depth and methodological expertise in the areas associated with the language sciences.

Admission Requirements

Students must apply and be admitted to the graduate program in Spanish and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Language Science dual-title program. Refer to the Admission Requirements section of the Language Science Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/language-science/>). Doctoral students must be admitted into the dual-title degree program in Language Science prior to taking the qualifying examination in their primary graduate program.

Degree requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the Ph.D. in Spanish, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual-title in Language Science, listed on the Language Science Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/language-science/>).

Particular courses may satisfy both the Spanish requirements and those in the Language Science dual-title program. Final course selection is determined by the student after consultation in advance with their advisers. A student's Ph.D. committee can require additional course work depending on the student's background and research plans.

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Spanish and must include at least one Graduate Faculty member from the Language Science program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Spanish and Language Science. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Spanish and Language Science dual-title Ph.D. student must include at least one member of the Language Science Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Language Science, the member of the committee representing Language Science must be appointed as co-chair. The Language Science representative on

the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Spanish and Language Science. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title Ph.D. in Spanish and Visual Studies

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Graduate students with interests in Spanish and/or Latin American literature and visual media may apply to the dual-title Ph.D. in Spanish and Visual Studies. The goal of the dual-title Ph.D. in Spanish and Visual Studies is to enable graduate students from Spanish to acquire the knowledge and skills of their major area of specialization in Spanish and/or Latin American literature, while at the same time gaining the theories and methods of Visual Studies.

Admission Requirements

To pursue a dual-title degree under this program, the student must first apply to the Graduate School and be admitted through the Department of Spanish, Italian, and Portuguese (see the Admission Requirements tab). After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Visual Studies dual-title program. Refer to the Admission Requirements section of the Visual Studies Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/visual-studies/>). Students must receive approval from the Director of Graduate Studies in Spanish, and must submit a recommendation from a member of the Spanish Graduate Faculty who is also a member of the Visual Studies Graduate Faculty. Doctoral students must be admitted into the dual-title degree program in Visual Studies prior to taking the qualifying examination in Spanish.

Degree Requirements

To qualify for the dual-title degree, students must satisfy all of the degree requirements listed on the Degree Requirements tab for the Ph.D. degree in Spanish. In addition, students must complete the degree requirements for the dual-title in Visual Studies, listed on the Visual Studies Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/visual-studies/>). At least 9 of the 24 credits required for the Visual Studies dual-title must be from Spanish courses dealing with questions of visuality. These courses must be chosen in consultation with the Director of Graduate Studies in Spanish.

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Spanish and must include at least one Graduate Faculty member from the Visual Studies program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Spanish and Visual Studies. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>), the Ph.D. committee of a Spanish and Visual Studies dual-title Ph.D. student must include at least one member of the Visual Studies Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Visual Studies, the member of the committee representing Visual Studies must be appointed as co-chair. The Visual Studies representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Spanish and Visual Studies. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

The department awards annually an Edwin Erle Sparks Fellowship in the Humanities. In the past several years, graduate students have received external NSF fellowships and awards such as Doctoral Dissertation Research Improvement grants.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by

graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Spanish (SPAN) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/span/>)

Learning Outcomes

Master of Arts (M.A.)

1. **KNOW:** Develop a cohesive body of scholarly knowledge in one of two broad fields: a) Lusó-Hispanic studies; or b) Hispanic linguistics..
2. **APPLY/CREATE:** Demonstrate the ability to initiate independent research in a specific field within Lusó-Hispanic studies or Hispanic linguistics.
3. **THINK:** Demonstrate analytical competence—using a range of approaches—in written scholarly work on: a) texts and other cultural productions from the Lusó-Hispanic traditions; or b) topics in Hispanic linguistics.
4. **COMMUNICATE:** Demonstrate knowledge of the conventions of presenting research to scholarly audiences in a variety of professional academic venues, including conferences.
5. **PROFESSIONAL PRACTICE:** Demonstrate ability to uphold standards of academic, professional, and ethical integrity in research and teaching.

Doctor of Philosophy (Ph.D.)

1. **KNOW:** Demonstrate in-depth scholarly knowledge in one of two broad fields: a) Lusó-Hispanic studies; or b) Hispanic linguistics.
2. **APPLY/CREATE:** Demonstrate analytical competence—using a range of approaches—in written scholarly work on: a) texts and other cultural productions from the Lusó-Hispanic traditions; or b) topics in Hispanic linguistics.
3. **THINK:** Formulate and carry out an independent research project that significantly furthers knowledge and theory in a specific field within Lusó-Hispanic studies or Hispanic linguistics.
4. **COMMUNICATE:** Demonstrate in-depth mastery of the conventions of presenting research to scholarly audiences in a variety of professional academic venues, including conferences and journals.
5. **PROFESSIONAL PRACTICE:** Demonstrate ability to uphold standards of academic, professional, and ethical integrity in research and teaching.

Contact

Campus	University Park
Graduate Program Head	Paola Eulalia Migliaccio-Dussias
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Judith Sierra-Rivera
Program Contact	Heather Rutten 442 Burrowes Building University Park PA 16802 hxr87@psu.edu (814) 863-0997
Program Website	View (http://sip.la.psu.edu)

Spatial Data Science

Graduate Program Head	Anthony C. Robinson
Program Code	SDS
Campus(es)	World Campus (M.S.)
Degrees Conferred	Master of Science (M.S.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=SDS)

The Master of Science in Spatial Data Science (SDS) degree is awarded to students who demonstrate mastery of the scientific, technical, and leadership competencies required to research, design, and evaluate spatial data science methods and technologies in a wide range of decision-making contexts.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Additional requirements imposed by the Department of Geography include:

- Statement of professional experience and goals. A résumé should be attached as a supplement, but the statement itself should be an essay (two to three pages) that demonstrates the applicant's written communication skills and clarifies the applicant's objectives in completing the degree program;
- Two letters of recommendation that attest to the applicant's readiness for graduate study;
- Official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>), including the institution that conferred the applicant's baccalaureate degree (and any graduate degrees, if applicable);
- Test of English as a Foreign Language (TOEFL) or International English Language Testing System (IELTS) score, if applicable;
- Nonrefundable application fee.

Applications will be evaluated by the SDS Admissions Committee based on the applicants' technical qualifications for the program relative to their previous educational experience, academic interests, and English Language proficiency. In general, successful applicants are expected to have earned an undergraduate grade-point average of at least 3.0 on a 4.0 scale. Applicants with a marginal record are encouraged to first complete a related Graduate Certificate before applying for admission to the SDS program. Exemplary performance in the Graduate Certificate will be taken into consideration for possible admission into the SDS program, but completion of a certificate does not imply or guarantee admission into a degree program.

Credits earned at other institutions but not used to earn a degree may be applied toward the requirements for a graduate degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>).

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A minimum of 33 credits at the 400, 500, 600, or 800 level is required. At least 18 credits must be in 500- or 600-level courses. Students choosing to complete a thesis must complete a minimum of 36 credits, with at least 6 credits in thesis research (GEOG 600 or GEOG 610). Students choosing to complete a capstone course must complete at least 18 credits in 500-level courses, including 3 credits in GEOG 570 Capstone in Spatial Data Science.

Code	Title	Credits
Required Courses		
Complete the following 5 required courses that total 15 credits with a grade point average of 3.00 or higher.		
GEOG 485	GIS Programming and Software Development	3
GEOG 486	Cartography and Visualization	3
GEOG 580	GEOVISUAL ANALYTICS	3
GEOG 583	Geospatial System Analysis and Design	3
GEOG 586	Geographical Information Analysis	3
Electives		
Complete a minimum of 9 credits of Spatial Data Science Methods electives in 400-, 500-, or 800-level courses. The courses that will satisfy this requirement can be chosen from a list of approved courses maintained by the graduate program office.		
Complete a minimum of 6 credits of Spatial Data Science Applications electives in 400-, 500-, or 800-level courses. The courses that will satisfy this requirement can be chosen from a list of approved courses maintained by the graduate program office.		
Culminating Experience		
A capstone course or thesis must be completed to meet the specific requirement of the culminating experience. The capstone course will demonstrate analytical thinking and synthesis of knowledge in the field of spatial data science. The thesis will demonstrate original research in the field of spatial data science to their adviser, a second reader, and the director of the SDS graduate program.		
Choose one of the following depending on whether a capstone course or thesis is completed:		
GEOG 570	Capstone in Spatial Data Science (Capstone Course)	3
GEOG 600 or GEOG 610	Thesis Research (Thesis) Thesis Research Off Campus	6
Total Credits		33-36

Candidates may choose a capstone course or thesis option to fulfill their culminating experience requirement and demonstrate integration of knowledge and research experience acquired during their time in the spatial data science degree program. Students who choose the capstone course option must complete a work product advised by a Graduate

Faculty member that demonstrates analytical thinking and synthesis of knowledge in the field of spatial data science. Students choosing the capstone course option will register for 3 credits of GEOG 570 Capstone in Spatial Data Science. Students will be encouraged to utilize an industry internship or current employer to identify a relevant or practical problem of importance that spatial data science methods could address, and to advance the state of the art in order to solve that problem. Students will be required to produce a paper and to present their results. The quality of the required paper is such that it must be suitable for publication in a professional journal or proceedings at a national or international conference.

Candidates who choose the thesis option must write and defend, at an oral examination, a thesis based upon original research in the field of spatial data science. The thesis will demonstrate depth of knowledge to their adviser, a second reader, and the director of the SDS graduate program. Candidates must submit a thesis following the procedures specified by the Graduate School and register for 6 credits of GEOG 600/GEOG 610. The thesis must be accepted by the adviser and committee members, the head of the graduate program, and the Graduate School, and the student must pass the thesis defense. Students who choose the thesis option for their culminating experience are expected to take two years to complete the degree.

Complementary Electives

Students in the SDS program may take individual courses outside of Geography as electives if approved by the SDS program director.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate

student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Geography (GEOG) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/geog/>)

Learning Outcomes

Master of Science (M.S.)

Explain and communicate the distinguishing characteristics of spatial data, including how spatial data are created, sensed, stored, manipulated, and represented distinctly compared to other data types.

Practice the science of spatial analysis and modeling, leveraging advances in geocomputation, geovisual analytics, open geospatial data, and spatial thinking to develop ethically responsible and reproducible workflows across the lifecycle of spatial data science problems.

Architect, implement, and deploy solutions that advance the state of the art in spatial data science to solve problems by leveraging and integrating contemporary computational, spatial data, and spatial visualization frameworks, including open source options.

Research, critique, and visually communicate spatial data quality and map spatial analysis results in support of analytical reasoning and ethical decision making in a variety of data intensive spatial data science contexts.

Contact

Campus	World Campus
Graduate Program Head	Anthony C Robinson
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Anthony C Robinson
Program Contact	Julene A Santiago jas9616@psu.edu (814) 865-2557

Special Education

Graduate Program Head	P Karen Murphy
Program Code	SPLED
Campus(es)	University Park (Ph.D., M.S., M.Ed.) World Campus (M.Ed.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Master of Education (M.Ed.) Dual-Title Ph.D., M.S., and M.Ed. in Special Education and Comparative and International Education
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=SPLED)

Exceptional children are those who deviate so far from average in physical, intellectual, emotional, or social characteristics that they require highly specialized instruction and related services. The purpose of the M.Ed. program in Special Education is to prepare educational service providers of exceptional children in advanced training in academic and behavior management strategies. M.Ed. students are trained in behavior management and instructional design, implementation, and

evaluation appropriate for effective work with children and youth who qualify for services for intellectual, behavioral, or physical disabilities at all age levels and degrees of severity. The purpose of the M.S. and Ph.D. programs is to prepare researchers and college and university teachers in areas encompassing the education of the children and youth who qualify for services for intellectual, behavioral and/or physical disabilities. The former program is professional in nature; the latter two, academic.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Applicants for master's and doctoral programs must present evidence of superior academic achievement, complete a personal statement, and provide professional references. Applications for the M.S. and Ph.D. programs must also present GRE verbal and quantitative test scores. Minimum GPA for master's and doctoral applicants are, respectively, 3.00 for M.Ed. and M.S., and 3.50 for Ph.D. Minimum GRE test scores are (verbal and quantitative combined): 290 for M.S., and 300 for Ph.D. Applicants for doctoral study must have had at least three years of relevant experience with special-needs children or youth. Exceptions to the admissions criteria may be made only for highly qualified students with special backgrounds, abilities, and interests. At the discretion of a graduate program, a student may be admitted provisionally for graduate study in a program without these scores.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of Education (M.Ed.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Prerequisites for the M.Ed. program include 10 credits basic to the education of exceptional children (courses comparable to SPLED 400, SPLED 403A or SPLED 403B, and SPLED 418). M.Ed. candidates are expected to complete the core:

Code	Title	Credits
Required Courses		
SPLED 525	Teaching Learners with Disabilities in Inclusive Settings	3
SPLED 573	Introduction to Research in Special Education	3
SPLED 521	Capstone Seminar in Special Education (or the equivalent)	3
Electives		
Elective credits ¹		23-28
Total Credits		32-37

¹ At least 21 must be taken in special education and include courses selected by students in conjunction with their adviser.

M.Ed. students must submit a master's paper.

All requirements for the M.Ed. must be met within six years or a period spanning seven consecutive summers.

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

M.S. candidates are expected to complete the core:

Code	Title	Credits
Required Courses		
SPLD 573	Introduction to Research in Special Education	3
EDPSY 400	Introduction to Statistics in Educational Research	3
Electives		
Of these 18 credits, 6 credits must be taken from one discipline outside of education.		18
Culminating Experience		
SPLD 600	Thesis Research	6
Total Credits		30

Students must complete a total of 18 credits in special education; and 18 credits at the 500 and 600 level, combined. M.S. students must submit a master's thesis and pass a comprehensive examination.

All requirements for the M.S. degree must be met within six years or a period spanning seven consecutive summers.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The communication and foreign language requirement for the Ph.D. degree is prescribed by each student's Ph.D. committee. Minimum requirements for the Ph.D. degree include:

- 24 credits of research methods;
- 18 credits in a cognate area such as psychology, sociology, or child development; and
- 36 credits in education.

The student also must enroll in SPLD 500 each semester prior to successful completion of the comprehensive examinations. A qualifying examination is required after the first semester of full-time study; written and oral comprehensive examinations also are required. A student is required to complete the program within seven years from the date of successful completion of the qualifying examination.

Dual-Titles

Dual-Title M.Ed., M.S., and Ph.D. in Special Education and Comparative and International Education

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/).

Admission Requirements

Students must apply and be admitted to the graduate program in Special Education and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Comparative and International Education dual-title program. Refer to the Admission Requirements section of the Comparative and International Education Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/comparative-international-education/>). Doctoral students must be admitted into the dual-title degree program in Comparative and International Education prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Special Education. In addition, students must complete the degree requirements for the dual-title in Comparative and International Education, listed on the Comparative and International Education Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/comparative-international-education/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Special Education and must include at least one Graduate Faculty member from the Comparative and International Education program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Special Education and Comparative and International Education. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Special Education and Comparative and International Education dual-title Ph.D. student must include at least one member of the Comparative and International Education Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Comparative and International Education, the member of the committee representing Comparative and International Education must be appointed as co-chair. The Comparative and International Education representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Special Education and Comparative and International Education. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

The following award typically has been available to graduate students in this program:

U.S. Office of Education Assistantships or Traineeships in Special Education

Open to graduate students being prepared as leadership personnel in special education; stipend varies, depending on conditions of existing grants. Other graduate assistantships also may be available. Apply to the Graduate Admissions Committee, 125D CEDAR Building.

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Special Education (SPLED) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/spled/>)

Contact

Campus	University Park
Graduate Program Head	P Karen Murphy
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	David Lee
Program Contact	Elizabeth Renae Davis 125 CEDAR Bldg University Park PA 16802 erd5338@psu.edu (814) 863-1699
Program Website	View (https://ed.psu.edu/academics/departments/department-educational-psychology-counseling-and-special-education/special-education/)
Campus	World Campus
Graduate Program Head	P Karen Murphy
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	David Lee
Program Contact	Paul Smith pms5249@psu.edu (814) 863-4452
Program Website	View (https://ed.psu.edu/academics/departments/department-educational-psychology-counseling-and-special-education/special-education/)

Statistics

Graduate Program Head	Murali Haran
Program Code	STAT, ASTAT
Campus(es)	University Park (Ph.D., M.S., M.A.S.) World Campus (M.A.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Master of Applied Statistics (M.A.S.) Dual-title Ph.D. in Statistics and Climate Science Dual-title Ph.D. and M.S. in Statistics and Operations Research Dual-title Ph.D. in Statistics and Social Data Analytics Integrated B.A. or B.S. in Mathematics and M.A.S. in Applied Statistics Integrated B.S. in Statistics and M.A.S. in Applied Statistics Integrated B.S. in Data Sciences and M.A.S. in Applied Statistics
The Graduate Faculty	STAT (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=STAT) ASTAT (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=ASTAT)

Graduate instruction and research opportunities are available in most areas of statistics and probability, including linear models, nonparametric statistics, robustness, statistical computing, analysis of count data, multivariate analysis, experimental design, reliability, stochastic processes and probability (applied and theoretical), distribution theory, statistical ecology, and biometrics.

Graduate students can gain practical experience in the application of statistical methodology through participation in the department's statistical consulting center and collaborative research activities. In addition, collaborative projects with other departments provide longer term experience and support for selected students. Most students gain valuable teaching experience by assisting in the teaching and grading of courses. In addition, Ph.D. students with proper qualifications can receive support for teaching undergraduate courses.

The Master of Applied Statistics (M.A.S.) program is a professional degree designed to provide training in statistics focused on developing data analysis skills, and exploration of all core areas of applied statistics, without going deeply into the mathematical statistics foundations. It aims to provide its graduates with broad knowledge in a wide range of statistical application areas.

The Doctor of Philosophy (Ph.D.) and Master of Science (M.S.) degrees in Statistics are designed for advanced studies in applied and theoretical statistics. Special emphases include biostatistics, statistical ecology, environmental statistics, genometrics, biometrics and statistical computation. The M.S. degree is appropriate preparation for the department's Ph.D. degree.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

While applications from all students (including those who already have done graduate work) are reviewed, completion of a standard calculus sequence is regarded as a prerequisite. Students with a 3.00 or better junior/senior average (on a 4.00 scale) and with appropriate course backgrounds will be considered for admission. The best-qualified applicants will be accepted up to the number of spaces that are available for new students. Exceptions to the minimum 3.00 grade-point average may be made for students with special backgrounds, abilities, and interests. Students hoping to earn a Ph.D. in statistics may apply directly to the Ph.D. program without need for a master's degree.

GRE scores are not required for admission.

Degree Requirements

Master of Applied Statistics (M.A.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

For the M.A.S. degree, a minimum of 30 credits and a minimum grade-point average of 3.0 are required for graduation. Of the 30 credits, 24 must be courses from the Statistics department and 21 must be at the 500 level. The student must complete:

Code	Title	Credits
Required Courses		
<i>Applied Statistics</i>		
STAT 501	Regression Methods	3
STAT 502	Analysis of Variance and Design of Experiments	3
<i>Mathematical Statistics</i>		
STAT 414	Introduction to Probability Theory	3
STAT 415	Introduction to Mathematical Statistics	3
<i>Statistical Consulting</i>		
STAT 580	Statistical Consulting Practicum I	2
Electives		
To complete the remaining credit requirements, a student can select 9-15 9-15 credits from the following applied statistics courses:		
STAT 464	Applied Nonparametric Statistics	
STAT 480	Introduction to SAS	
STAT 500	Applied Statistics	
STAT 503	Design of Experiments	
STAT 504	Analysis of Discrete Data	
STAT 505	Applied Multivariate Statistical Analysis	
STAT 506	Sampling Theory and Methods	
STAT 507	Epidemiologic Research Methods	
STAT 509	Design and Analysis of Clinical Trials	
STAT 510	Applied Time Series Analysis	
In addition, students with suitable backgrounds may choose up to 6 0-6 credits from a departmental list of additional courses with approval from their adviser.		
Culminating Experience		
STAT 581	Statistical Consulting Practicum II (Capstone Project) ¹	1
Total Credits		30

¹ For all M.A.S. students, the STAT 581 course will have a comprehensive written project report required as part of the course, which serves as the culminating experience.

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

For the M.S. degrees, a student must complete at least 30 credits at the 400, 500, 600, or 800 level, including at least 27 at the 500 or 600 level and a minimum of 6 credits of thesis research (600 or 610); 21 of the 27 500-level credits must be formal course work from the Department of Statistics. A student must complete:

Code	Title	Credits
Required Courses		
<i>Applied Statistics</i>		
STAT 511	Regression Analysis and Modeling	3
STAT 512	Design and Analysis of Experiments	3
<i>Mathematical Statistics</i>		
STAT 513	Theory of Statistics I	3
STAT 514	Theory of Statistics II	3
<i>Stochastic Processes</i>		

STAT 515	Stochastic Processes and Monte Carlo Methods	3
<i>Statistical Consulting</i>		
STAT 580	Statistical Consulting Practicum I	2
STAT 581	Statistical Consulting Practicum II	1
Electives		
6 credits of electives		6
Culminating Experience		
STAT 600	Thesis Research	6
or STAT 610	Thesis Research Off Campus	
Total Credits		30

The student must also pass a written master's qualifying examination taken at the end of the first year. The thesis must be accepted by the advisers, a second reader, the head of the graduate program, and the Graduate School.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The Department of Statistics requires a minimum total of 48 postbaccalaureate credits for the Ph.D. At least 42 credits, exclusive of the dissertation, must be in Statistics. Course work accepted for the M.S. in Statistics at Penn State will count toward the department's 48-credit requirement. In the case of students who have earned credits in an advanced degree program at another university or in another department at Penn State, a maximum of 24 credits may count toward the 48-credit departmental requirement, subject to departmental approval.

For the Ph.D. degree, a student in Statistics must complete at least 48 credits, of which at least 42 must be STAT and at most three credits can be at the 400 level.

Code	Title	Credits
Required Courses		
<i>Core Course Requirements</i>		
STAT 511	Regression Analysis and Modeling	3
STAT 512	Design and Analysis of Experiments	3
STAT 513	Theory of Statistics I	3
STAT 514	Theory of Statistics II	3
STAT 515	Stochastic Processes and Monte Carlo Methods	3
STAT 553	Asymptotic Tools	3
<i>Additional Courses</i>		
STAT 517	Probability Theory	3
STAT 561	Statistical Inference I	3
STAT 580	Statistical Consulting Practicum I	2
STAT 581	Statistical Consulting Practicum II	1
STAT 590	Colloquium	2
STAT 592	Teaching Statistics	1
Electives		
Select 18 credits of the following:		18
STAT 518	Probability Theory	
STAT 544	Categorical Data Analysis I	
STAT 552	Linear Models II	
STAT 562	Statistical Inference II	
STAT 565	Multivariate Analysis	

Other courses approved by the Graduate Studies Committee

Total Credits **48**

Doctoral students must pass a qualifying examination, a comprehensive written and oral examination, and a final oral examination (the dissertation defense). To earn the Ph.D. degree, doctoral students must also write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor Requirements

Requirements listed here are in addition to requirements for minors in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Doctoral Minor in Statistics

The Department of Statistics has three possible paths for a Doctoral Minor in Statistics:

- Path 1: STAT 414/MATH 414 and STAT 415/MATH 415 and at least three 500-level courses from the department.
- Path 2: Five or more courses totaling 15 credits at the 500-level from the department. STAT 464 may also count toward the 15 credits.
- Path 3: Four 500-level courses totaling 12 credits from the department and one additional course of 3 credits approved by the department head or graduate studies chair.

Please note: STAT 500 will not be counted toward the Doctoral Minor in Statistics under any path.

For all paths, a 3.5 GPA is required in the courses to be counted toward the minor. Completion of one of the paths listed above, with the specified grade-point average, and the signature on the Graduate Minor Program form (<http://stat.psu.edu/education/graduate-minor-application/view/>) constitutes approval of the Minor in Statistics. Official requests to add a minor to a doctoral student's academic record must be submitted to Graduate Enrollment Services prior to establishment of the Ph.D. committee and prior to scheduling the comprehensive examination. At least one Graduate Faculty member from the minor field must be on the student's Ph.D. committee.

Dual-Titles

Dual-title Ph.D. in Statistics and Climate Science

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Climate Science (<https://bulletins.psu.edu/graduate/programs/majors/climate-science/>) is a field devoted to the study of Earth's climate in the past, present, and future. A particular focus is understanding the effects of human activities (anthropogenic impacts) and natural forcing on climate. The Climate Science dual-title degree program is administered by the Department of Meteorology and Atmospheric Science for the participating graduate programs. The dual-title degree program is offered through participating programs in the College of Earth and Mineral Sciences and, where appropriate, other graduate programs in the University. The program enables students from several graduate programs to gain the perspectives, techniques, and methodologies

of Climate Science, while maintaining a close association with major program areas of application.

Admission Requirements

Students must apply and be admitted to the graduate program in Statistics and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Climate Science dual-title program. Refer to the Admission Requirements section of the Climate Science Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/climate-science/>). Doctoral students must be admitted into the dual-title degree program in Climate Science no later than the end of the fourth semester (not counting summer semesters) of entry into the graduate major program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the Ph.D. in Statistics. In addition, students must complete the degree requirements for the dual-title in Climate Science, listed on the Climate Science Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/climate-science/>). The qualifying examination in the Statistics satisfies the qualifying exam requirement for the dual-title degree program in Climate Science.

Ph.D. Committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Climate Science dual-title doctoral degree student must include at least one member of the Climate Science Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Climate Science, the member of the committee representing Climate Science must be appointed as co-chair. The Climate Science representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Dissertation and Dissertation Defense

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in both Statistics and Climate Science. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the Statistics graduate program, and the Graduate School.

Dual-Title M.S. and Ph.D. in Statistics and Operations Research

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

The Operations Research dual-title degree program is administered by an Operations Research committee, which is responsible for management of the program. The program enables students from diverse graduate programs to attain and be identified with the tools, techniques, and methodology of operations research, while maintaining a close association with areas of application. Operations research is the analysis—usually involving mathematical treatment—of a process,

problem, or operation to determine its purpose and effectiveness and to gain maximum efficiency.

Admission Requirements

Students must apply and be admitted to the graduate program in Statistics and the Graduate School before they can apply for admission to the dual-title degree program. Students are encouraged to submit their application forms as early as possible. Doctoral students must be admitted into the dual-title degree program in Operations Research no later than the end of the fourth semester (not counting summer semesters) of entry into the graduate major program. The "Request for Dual-Title Degree in Operations Research" form must be filled out in consultation with the Graduate Coordinator in the Statistics Department and submitted to the Chair of the Operations Research Program.

For the M.S. dual-title degree in Operations Research (<https://bulletins.psu.edu/graduate/programs/majors/operations-research/>), in addition to those prescribed by the graduate major program, prerequisites for acceptance to the program without deficiency include the following or their equivalent:

Code	Title	Credits
MATH 140	Calculus With Analytic Geometry I	4
MATH 141	Calculus with Analytic Geometry II	4
MATH 220	Matrices	2-3
CMPSC 101	Introduction to Programming	3
	3 credits of probability and statistics	3

The "Request for Masters Dual-Title Degree in Operations Research" form must be filled out.

For the Ph.D. dual-title degree in Operations Research (<https://bulletins.psu.edu/graduate/programs/majors/operations-research/>), in addition to those prescribed by the graduate major program, prerequisites for acceptance to the program without deficiency include the following or their equivalent:

Code	Title	Credits
MATH 401	Introduction to Analysis I	3
MATH 436	Linear Algebra	3
CMPSC 101	Introduction to Programming	3
	3 credits of probability and statistics	3

The "Request for Ph.D. Dual-Title Degree in Operations Research" form must be filled out.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the requirements for the degree they are enrolled in Statistics. In addition, they must satisfy the requirements described below, as established by the Operations Research committee.

For the M.S. dual-title degree in Operations Research (<https://bulletins.psu.edu/graduate/programs/majors/operations-research/>), the minimum requirements are:

- 6 credits in stochastic/statistical methods, including a minimum of 3 credits in each of the areas of statistical methods and stochastic processes;
- 6 credits in optimization, including a minimum of 3 credits in linear programming;

- 3 credits in computational methods; and
- 3 credits in applications/specialization.

A minimum of 9 credits must be in the 500 series. Particular courses may satisfy both the graduate major program requirements and those in the Operations Research program. The supervisor of the master's thesis must be a member of the Graduate Faculty recommended by the chair of the program granting the degree and approved by the Operations Research committee as qualified to supervise thesis work in operations research.

The minimum requirements for the Ph.D. dual-title degree in Operations Research (<https://bulletins.psu.edu/graduate/programs/majors/operations-research/>) are:

- 9 credits in stochastic/statistical methods, including a minimum of 3 credits in each of the areas of statistical methods and stochastic processes;
- 9 credits in optimization, including a minimum of 3 credits in linear programming;
- 6 credits in computational methods, including a minimum of 3 credits in simulation; and
- 12 credits in applications/specialization.

A minimum of 18 credits must be in the 500 series, and particular courses may satisfy both the graduate major program requirements and those in the Operations Research (<https://bulletins.psu.edu/graduate/programs/majors/operations-research/>) program.

Qualifying Exam

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Statistics and must include at least one Graduate Faculty member from the Operations Research program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Statistics and Operations Research. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

Ph.D. Committee Composition

The Ph.D. committee must conform to all requirements of the primary program and the Graduate Council. In accordance with Graduate Council policy (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>), the Ph.D. committee of a Statistics and Operations Research (<https://bulletins.psu.edu/graduate/programs/majors/operations-research/>) dual-title doctoral degree student must include at least one member of the Operations Research Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role.

If the chair of the committee representing Statistics is not also a member of the Graduate Faculty in Operations Research (<https://bulletins.psu.edu/graduate/programs/majors/operations-research/>), the member of the committee representing Operations Research must be appointed as co-chair.

Comprehensive Exam

After completing all course work, doctoral students in the dual-title doctoral degree program in Statistics and Operations Research (<https://bulletins.psu.edu/graduate/programs/majors/operations-research/>)

must pass a comprehensive examination that includes written and oral components.

There are two ways for students to complete their comprehensive examination.

Typically, both written and oral components of the comprehensive examination involve the defense of a dissertation proposal, which must contain core Statistics content and substantial Operations Research content, and is evaluated by the Ph.D. committee. The Operations Research representative(s) on the student's Ph.D. committee will participate in the evaluation of the comprehensive examination.

Alternatively, the student may have a written and oral comprehensive exam focusing on at least two key areas in Statistics with content from Operations Research (acting as a first minor field). The examination focuses on the dissertation prospects and the student's preparation to undertake dissertation research, and is evaluated by the Ph.D. committee. The Operations Research representative(s) on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination. A written and oral defense of a dissertation proposal would then occur at a later stage as per committee's recommendation.

Dissertation and Dissertation Defense

Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. Students enrolled in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Statistics and Operations Research (<https://bulletins.psu.edu/graduate/programs/majors/operations-research/>). The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title Ph.D. in Statistics and Social Data Analytics

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Statistics doctoral students seeking to attain and be identified with an interdisciplinary array of tools, techniques, and methodologies for social data analytics, while maintaining a close association with statistics, may apply to pursue a dual-title Ph.D. in Statistics and Social Data Analytics (<https://bulletins.psu.edu/graduate/programs/majors/social-data-analytics/>). Social data analytics is the integration of social scientific, computational, informational, statistical, and visual analytic approaches to the analysis of large or complex data that arise from human interaction. The dual-title Ph.D. aims to enable scientists who expand the capability of social data analytics, and use those capabilities creatively to answer important social scientific questions and to address grand social challenges, in both academic and nonacademic settings.

Admission Requirements

Students must apply and be admitted to the graduate program in Statistics and the Graduate School before they can apply for admission to the dual-title degree program. Applicants interested in the dual-title degree program may make their interest in the program known clearly on their applications to Statistics and include remarks in their statement of purpose that address the ways in which their research and professional goals in statistics reflect an expanded interest in Social Data Analytics-related research.

To be enrolled in the dual-title doctoral degree program in Social Data Analytics, a student must submit a letter of application and transcript, which will be reviewed by the Social Data Analytics Admissions Committee. An applicant must have a minimum grade point average of 3.0 (on a 4-point scale) to be considered for enrollment in the dual-title degree program. Students must be admitted into the dual-title degree program in Social Data Analytics no later than the end of the fourth semester (not counting summer semesters) of entry into the primary Ph.D. program and before taking the comprehensive exam.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the requirements of the Ph.D. in Statistics. In addition, they must satisfy the requirements described below, as established by the Social Data Analytics Committee. Within this framework, final course selection is determined by the student in consultation with academic advisers from their home department and Social Data Analytics.

Course Work

The minimum course work requirements for the dual-title Ph.D. in Statistics and Social Data Analytics (<https://bulletins.psu.edu/graduate/programs/majors/social-data-analytics/>) are as follows:

- Course work and other requirements for the Ph.D. in Statistics.
- SODA 501 (3 credits)
- SODA 502 (3 credits)
- 12 or more elective credits in Social Data Analytics from a list of courses maintained by the Social Data Analytics Committee. Collectively the elective credits must satisfy the following requirements:
 - (A) Core analytics distribution. 3 or more credits in courses focused on statistical learning, machine learning, data mining, or visual analytics. Courses approved as meeting this requirement are designated (A) on the list of approved electives.
 - (Q) Quantification distribution. 6 or more credits in courses focused on statistical inference or quantitative social science methodology. Courses approved as meeting this requirement are designated (Q) on the list of approved electives. (A Statistics Ph.D. student would typically satisfy this distribution requirement as a function of completing the requirements of the Statistics Ph.D.)
 - (C) Computational / informational distribution. 6 or more credits in courses focused on computation, collection, management, processing, or interaction with electronic data, especially at scale. Courses approved as meeting this requirement are designated (C) on the list of approved electives.
 - (S) Social distribution. 6 or more credits in courses with substantial content on the nature of human interaction and/or the analysis of data derived from human interaction and/or the social context or ethics or social consequences of social data analytics. Courses approved as meeting this requirement are designated (S) on the list of approved electives. (A Statistics Ph.D. student would typically satisfy this distribution requirement as a function of completing the requirements of the Statistics Ph.D.)
 - Cross-departmental distribution.
 - 3 or more credits in approved courses with the prefix STAT or that of a primarily social science department. (A Statistics Ph.D. student would typically satisfy this distribution requirement as a function of completing the requirements of the Statistics Ph.D.)

- 3 or more credits in approved courses with the prefix IST, GEOG, or that of a primarily computer science or engineering department.
- 6 or more credits in approved courses outside Statistics.
- 3 or fewer credits in approved courses at the 400-level.

Students are encouraged to take interdisciplinary courses that carry multiple (A), (Q), (C), (S) designations, as well as to select SODA electives that also meet STAT requirements. In particular, the 12 elective SODA credits can be met with as few as 6 credits of appropriately chosen course work. Conversely, 6 credits of SODA course work, including SODA 501 and SODA 502, can be used to meet the STAT elective requirement. Within this framework, final course selection is determined by the student in consultation with academic advisers from Statistics and Social Data Analytics. (There are no formal maxima for the number of double-counted credits. For those meeting the SODA elective requirement with the minimum of 12 credits, the outside-program minimum effectively limits the number of primary degree STAT credits that count toward SODA at 6. For those meeting STAT elective requirements with the minimum of 18 credits, the 12 credit STAT minimum effectively limits the number of SODA credits that count toward STAT at 6.)

Qualifying Exam

The qualifying examination in Statistics satisfies the qualifying exam requirement for the dual-title degree program in Social Data Analytics.

Ph.D. Committee Composition

The Ph.D. committee must conform to all requirements of the primary program and the Graduate Council. In accordance with Graduate Council policy (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>), the Ph.D. committee of a Statistics and Social Data Analytics (<https://bulletins.psu.edu/graduate/programs/majors/social-data-analytics/>) dual-title doctoral degree student must include at least one member of the Social Data Analytics Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the committee representing Statistics is not also a member of the Graduate Faculty in Social Data Analytics, the member of the committee representing Social Data Analytics must be appointed as co-chair.

Comprehensive Exam

After completing all course work, doctoral students in the dual-title doctoral degree program in Statistics and Social Data Analytics must pass a comprehensive examination that includes written and oral components.

There are two ways for students to complete their comprehensive examination.

Typically, both written and oral components of the comprehensive examination involve the defense of a dissertation proposal, which must contain core Statistics content and substantial Social Data Analytics content, and is evaluated by the Ph.D. committee. The Social Data Analytics representative(s) on the student's Ph.D. committee will participate in the evaluation of the comprehensive examination.

Alternatively, the student may have a written and oral comprehensive exam focusing on at least two key areas in Statistics with content from Social Data Analytics (acting as a first minor field). The examination focuses on the dissertation prospects and the student's preparation to undertake dissertation research, and is evaluated by the Ph.D. committee. The Social Data Analytics representative(s) on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination. A written and oral defense

of a dissertation proposal would then occur at a later stage as per committee's recommendation.

Dissertation and Dissertation Defense

Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. Students enrolled in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Statistics and Social Data Analytics. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Integrated Undergrad-Grad Programs

Integrated B.A. or B.S. in Mathematics and M.A.S. in Applied Statistics

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The Integrated Undergraduate-Graduate (IUG) degree with B.A./B.S. in Mathematics and Master of Applied Statistics (M.A.S.) is designed to be completed in five years. This integrated degree will enable a select number of highly qualified and career-oriented students to obtain training in statistics focused on developing data analysis skills, and exploration of core areas of applied statistics at the graduate levels in addition to an undergraduate degree in Mathematics. The M.A.S. degree is a professional master's degree that emphasizes applications. The degree prepares students with interests in mathematics, computation, and the quantitative aspects of science for careers in industry and government as statistical analysts. Research divisions in the pharmaceutical industry, quality control, and quality engineering divisions in manufacturing companies, clinical research units, corporate planning and research units, and other data intensive positions require persons with training in mathematics, computation, database management, and statistical analysis, which this program will provide.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The number of openings in the integrated B.A./B.S. and M.A.S. program is limited. Students must apply to the program via the Graduate School application for admission (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet all the admission requirements of the Graduate School and the Applied Statistics graduate program for the Master of Applied Statistics degree, listed on the Admission Requirements tab. Admission will be based on specific criteria and the recommendation of faculty. Before applying to the Graduate School, students must have completed entrance to their undergraduate major, have completed no less than 60 credits, and be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. Applicants to the integrated program:

- Must be enrolled in the Mathematics B.A./B.S. program.
- Must have completed at least 60 credits of the undergraduate degree program including the two courses: STAT 414 and STAT 415.
- Must submit a transcript and a statement of purpose.
- Must present a departmental approved plan of study in the application process in consultation with the M.A.S. program director. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.
- Must be recommended by the chair of Mathematics Department's undergraduate program committee. Two additional recommendation letters must be sent to the M.A.S. admissions committee.
- Must be accepted to the M.A.S. program in Statistics.

Degree Requirements

Students must fulfill all degree requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Arts and Bachelor of Science in Mathematics are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). Degree requirements for the Master of Applied Statistics in Applied Statistics degree are listed on the Degree Requirements tab.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted. The courses that will double count for both degrees are:

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
STAT 414	Introduction to Probability Theory	3
STAT 415	Introduction to Mathematical Statistics	3
STAT 501	Regression Methods	3
STAT 502	Analysis of Variance and Design of Experiments	3
Total Credits		12

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.A.S. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Integrated B.S. in Statistics and M.A.S. in Applied Statistics

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The Integrated Undergraduate-Graduate (IUG) degree with B.S. in Statistics and Master of Applied Statistics (M.A.S.) is designed to be

completed in five years. This integrated degree will enable a select number of highly qualified and career-oriented students to obtain training in statistics focused on developing data analysis skills and exploration of core areas of applied statistics at the undergraduate and graduate levels. The M.A.S. degree is a professional master's degree that emphasizes applications and does not provide as much training in the mathematical and statistical theory. The degree prepares students with interests in mathematics, computation, and the quantitative aspects of science for careers in industry and government as statistical analysts. Research divisions in the pharmaceutical industry, quality control and quality engineering divisions in manufacturing companies, clinical research units, corporate planning and research units, and other data-intensive positions require persons with training in mathematics, computation, database management, and statistical analysis, which this program will provide.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The number of openings in the integrated B.S./M.A.S. program is limited. Students must apply to the program via the Graduate School application for admission (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>), and must meet all the admission requirements of the Graduate School and the Applied Statistics graduate program for the Master of Applied Statistics degree, listed on the Admission Requirements tab. Admission will be based on specific criteria and the recommendation of faculty. Before applying to the Graduate School, students must have completed entrance to their undergraduate major, have completed no less than 60 credits, and be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. Applicants to the integrated program:

- Must be enrolled in the Statistics B.S. program.
- Must have completed at least 60 credits of the undergraduate degree program, including the two courses: STAT 414 and STAT 415.
- Must submit a transcript and a statement of purpose.
- Must present a departmental approved plan of study in the application process in consultation with the M.A.S. program director. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.
- Must be recommended by the chair of the department's undergraduate program committee.
- Must be accepted into the M.A.S. program in Statistics.

Degree Requirements

Students must fulfill all degree requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Science in Statistics are listed in the Undergraduate Bulletin (<https://bulletins.psu.edu/undergraduate/>). Degree requirements for the Master of Applied Statistics in Applied Statistics degree are listed on the Degree Requirements tab.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of

the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted. The courses that will double count for both degrees are:

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
STAT 414	Introduction to Probability Theory	3
STAT 415	Introduction to Mathematical Statistics	3
STAT 501	Regression Methods	3
STAT 502	Analysis of Variance and Design of Experiments	3
Total Credits		12

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.A.S. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Integrated B.S. in Data Sciences and M.A.S. in Applied Statistics

This Integrated Undergraduate/Graduate (IUG) degree program combines the B.S. in Data Sciences with the M.A.S. in Applied Statistics offered at the following campuses:

Undergraduate Degree

- University Park

Graduate Degree

- University Park
- World Campus

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/>).

The Integrated Undergraduate-Graduate (IUG) degree with B.S. in Data Sciences and Master of Applied Statistics (M.A.S.) is designed to be completed in five years. This integrated degree will enable a select number of highly qualified and career-oriented students to obtain training in statistics focused on developing data analysis skills and exploration of core areas of applied statistics at the undergraduate and graduate levels. The M.A.S. degree is a professional master's degree that emphasizes applications rather than mathematical and statistical theory. The degree prepares students with interests in mathematics, computation, and the quantitative aspects of science for careers in industry and government as statistical analysts. Research divisions in the pharmaceutical industry, quality control and quality engineering divisions in manufacturing companies, clinical research units, corporate planning and research units, and other data-intensive positions require persons with training in mathematics,

computation, database management, and statistical analysis, which this program will provide.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The number of openings in the integrated B.S./M.A.S. program is limited. Students must apply to the program via the Graduate School application for admission, and must meet all the admission requirements of the Graduate School and the Applied Statistics graduate program for the Master of Applied Statistics degree, listed on the Admission Requirements tab. Admission will be based on specific criteria and the recommendation of faculty. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted to the IUG no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG. Applicants to the integrated program:

- Must be enrolled in the Data Sciences B.S. program.
- Must have completed at least 60 credits of the undergraduate degree program, including STAT 414.
- Must submit a transcript and a statement of purpose.
- Must present an approved plan of study in the application process in consultation with the M.A.S. program director. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.
- Must have three references, one of which is an approval letter from a representative on the Data Sciences' undergraduate program/ curriculum committee.
- Must be accepted into the M.A.S. program in Statistics.

Degree Requirements

Students must fulfill all degree requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Data Sciences are listed in the Undergraduate Bulletin. Degree requirements for the Master of Applied Statistics in Applied Statistics degree are listed on the Degree Requirements tab.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted. The courses that will double count for both degrees are:

Code	Title	Credits
Courses Eligible to Double Count for Both Degrees		
STAT 414	Introduction to Probability Theory	3
STAT 415	Introduction to Mathematical Statistics	3
STAT 501	Regression Methods ¹	3
STAT 502	Analysis of Variance and Design of Experiments ²	3
STAT 503	Design of Experiments	3
STAT 504	Analysis of Discrete Data	3

STAT 505	Applied Multivariate Statistical Analysis	3
STAT 506	Sampling Theory and Methods ³	3
STAT 508	Applied Data Mining & Statistical Learning	3

¹ If STAT 300 is taken for the BS degree, then STAT 501 cannot be double counted.

² If STAT 400 is taken for the BS degree, then STAT 502 cannot be double counted.

³ If STAT 466 is taken for the BS degree, then STAT 506 cannot be double counted.

Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.A.S. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

GRE scores are required for consideration for assistantships.

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Statistics (STAT) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/stat/>)

Learning Outcomes

Master of Applied Statistics (M.A.S.)

1. Graduates shall demonstrate conceptual and practical knowledge of the broad aspects of Statistical analysis techniques. The core areas of Applied Statistics (Regression Analysis, Design of Experiment, Analysis of Variance, Analysis of Discrete Data, MANOVA, and many more) will be explored.
2. Graduates will be able to apply the statistical analysis techniques they learn to real problems. They will demonstrate proficiency in

the working with others as a data analyst in a team setting, as well as in broad areas of data processing, data visualization, statistical analysis and interpretation of the statistical results. Students will also demonstrate adequate professional preparation for drawing sound conclusions and creating reports to aid in making decisions as data analysts and applied statisticians.

3. Graduates will demonstrate skills in communicating statistical findings and reports in a group setting and through oral presentations. They will be trained on development of recommendation reports, and discussion of consulting solutions.
4. Graduates will be able to demonstrate critical thinking skills when reviewing scientific papers, literature and numerical reports. They will be trained to have a firm grasp of statistical thinking and sound understanding of statistical conclusions.
5. Graduates will demonstrate knowledge of interpersonal working dynamics, ethical professional conduct and the ability to perform in a team environment. They will participate in professional networking, and engagement in professional activities and organizations serving the discipline and the industry.

Master of Science (M.S.) and Doctor of Philosophy (Ph.D.)

1. Graduates shall demonstrate in-depth and advanced knowledge and understanding in statistics core areas of probability, statistical inference, modeling and computing. The core demonstration will include the application of these principles to problems in various contexts such as genetics, medicine, biology, environmental studies, and social and behavioral sciences, that are crucial for the practice of modern statistics.
2. Graduates shall demonstrate, at a level appropriate to a departmental colloquium, (i) knowledge of several outstanding problems or questions in diverse sub-fields of statistics, (ii) the experimental and theoretical origins of these problems, and (iii) the principle efforts proposed or underway to address them, including demonstrating critical thinking skills when reviewing scientific papers, literature and numerical reports.
3. Graduates shall demonstrate the ability to communicate professionally, in written and oral form, research work and conclusions of statistical findings to statistical experts and non-expert audiences.
4. Graduates shall demonstrate (i) knowledge and understanding of professional standards of ethics and conduct, (ii) the ability to analyze situations to identify the standards that should apply including performing in a team environment, and (iii) describe how they may be appropriately acted upon. They will participate in professional networking, and engagement in professional activities and organizations serving the discipline and the broader scientific community and the industry.
5. Graduates shall have a specialty area within the broad domain of statistics, within which they shall demonstrate (i) advanced knowledge and understanding of the primary literature, (ii) the ability to analyze and judge new contributions to the primary literature, (iii) the ability to pose complex research problem(s) and identify the knowledge and methodologies required to address them, and (iv) the ability to apply that knowledge and those methodologies to create new knowledge and/or develop new theories and methods that advance (or show the potential to advance) knowledge and understanding within the specialty area, and to another discipline where their findings are applicable.

Contact

Campus	University Park
Graduate Program Head	Murali Haran
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Bing Li
Program Contact	Melanie Mckinney 326 Thomas Bldg. University Park PA 16802 mum1@psu.edu (814) 865-8630
Program Website	View (http://stat.psu.edu/education/graduate-programs/)

Strategic Communications

Graduate Program Head	Fuyuan Shen
Program Code	STCOM
Campus(es)	World Campus (M.P.S.)
Degrees Conferred	Master of Professional Studies (MPS)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=STCOM)

The MPS degree in Strategic Communications is a program of study for individuals who are in the early and middle stages of their strategic communications careers, currently in or aspiring to managerial positions. The content of the program will be appropriate for such individuals employed in a wide range of functional specialties and industry sectors, including advertising, public relations, and strategic communications.

The MPS degree in Strategic Communications examines the process and application of purposive mass communication that is delivered to specific target audiences through varied mass media and other communications channels. Program content exposes the student to a broad range of strategic communications theory, research, and practical application related to developing and implementing effective communications plans for companies and organizations of all types. Courses examine:

- how persuasive communication functions through mass media and other communication channels;
- how specific communications goals are developed based on theory and rationale;
- how strategic communications plans and campaigns are created and executed; and
- how the effectiveness of communications plans is measured and evaluated.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Educational Background

A minimum 3.00 junior/senior grade-point average (on a 4.00 scale) is recommended. Students also are expected to have some industry work experience prior to admission.

Language of Instruction

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Core Application Packet

- Completed official online Graduate School application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) and payment of nonrefundable application fee.
- Statement of purpose: a 2-3 page essay articulating career and educational goals that demonstrates the student's written communication skills.
- A current vita or résumé.
- Three letters of recommendation that attest to the student's readiness for graduate study and document the requisite industry experience. Letters must be submitted through the online application. Within the online application you will be asked to enter the names and email addresses of three individuals who will be providing your recommendation. Those individuals will receive a note via email asking them to complete a brief form that will serve as your recommendation. Please inform all recommenders they must submit the form in order for your application to be complete.
- Official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>).

Degree Requirements

Master of Professional Studies (M.P.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Total required credits for the MPS: at least 30 credits at the 400, 500, or 800 level; at least 27 must be at the 500 or 800 level, with at least 6 at the 500 level.

Code	Title	Credits
Required Courses		
COMM 530	Research Methods in Strategic Communications	3
COMM 531	Strategic Communications: Theory and Implementation	3
COMM 830	Strategic Communications Industry	3
COMM 831	Digital Media Analytics I	3
COMM 833	Ethics and Decision Making in Strategic Communications	3
Electives		
Select 6 credits of the following:		6
COMM 832	Multimedia Content Development and Delivery	
COMM 835	Social Media Communications	
COMM 836	Strategic Communications Leadership	

COMM 837	Reaching Multicultural Populations in Strategic Communications	
COMM 838	Strategic Communications Law	
COMM 839	Digital Media Analytics II	
Select 6 credits from any World Campus course(s), including the elective courses listed above.		6
Culminating Experience		
COMM 834	Strategic Communications Campaigns (Capstone Course)	3
Total Credits		30

¹ These 6 credits can be at the 400-level.

The culminating experience provides students with an opportunity to apply their knowledge of the theories and principles concerning strategic communications to a practical campaign project. Specific campaign clients and scope can vary, but all representative aspects of each project would include:

- setting effective communications goals;
- identifying proper target audiences to best achieve the goals;
- developing specific, effective messages for each target audience;
- creating the message content across multiple media platforms;
- implementing a message-delivery plan that optimizes effectiveness and efficiency; and
- evaluating campaign performance against predetermined, measurable benchmarks.

Course Substitutions

Substitutions for the above prescribed courses, either with resident-education courses, alternate online courses, or courses from other institutions, will be considered on a case-by-case basis subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>), and must be petitioned and approved in advance by the program administrator, with input from the student's adviser.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Communications (COMM) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/comm/>)

Contact

Campus	World Campus
Graduate Program Head	Fuyuan Shen
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Ann Marie Major
Program Contact	Ann Marie Major 115 Carnegie Building University Park PA 16802 amm17@psu.edu (814) 865-3069
Program Website	View (https://bulletins.psu.edu/graduate/programs/majors/strategic-communications/)

Strategic Management and Executive Leadership

Graduate Program Head	Vilmos Misangyi
Program Code	SMEXL
Campus(es)	World Campus (M.Mgt.)
Degrees Conferred	Master of Management (M.Mgt.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=SMEXL)

The Master of Management in Strategic Management and Executive Leadership program will prepare graduates to stand out in a competitive job market by studying at a highly reputed business school with some of the world's leading academic thinkers and industry experts. This program will provide students with the strategic management, leadership, and organizational capabilities essential for a senior-level leadership position. Students will learn the skills to formulate compelling strategies, align organizational elements in the pursuit of those strategies, and build culture and commitment across an organization. The program will be taught by the same world-class professors who teach our M.B.A. students. A solid foundation in strategy, leadership, organizational change, diversity and ethics will make the target audience more attractive for positions of increasing leadership responsibility and prepare them to advance more rapidly into those positions. These learning outcomes will be achieved by a combination of lectures by faculty, invited guest

lecturers, reading of key literature, individual and team projects, and practical involvement in a leadership culminating experience.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

A completed online Graduate School Application for Admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>) is required, including:

- A minimum of 5 years of management experience. Exceptional candidates who fall outside of this guideline may be considered.
- Statement of purpose: a 2-3 page essay articulating career and educational goals.
- Résumé reflecting relevant experience.
- Official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>).
- Additional information may be requested by the program.

GMAT and/or GRE scores will not be required for admission. Accordingly, these scores will not be accepted.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Exceptions to GCAC-305 (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) will be considered by the program. Exceptions may or may not be granted by the Graduate School.

Degree Requirements

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

A minimum of 30 credits at the 400, 500, or 800 level is required, with a minimum of 18 credits at the 500 or 800 level, and at least 6 credits at the 500 level.

Code	Title	Credits
Required Courses		
The core SMEXL courses are designed to teach students to think more strategically, assess external trends, learn from exemplar organizations, and enhance their ability to formulate, articulate, and implement strategy.		
MBADM 571	Global Strategic Management	3

MGMT 565	Power and Influence	3
MGMT 831	Strategy Implementation and Organizational Change	3
MGMT 845	Leading Diverse Organizations	1-3
BA 804	Ethical Leadership	3
Primary Concentrations		
In addition to the core curriculum, students will select a 6-credit primary concentration in the fields of either Negotiations and Influence, Corporate Innovation and Entrepreneurship, or Business Sustainability Strategy. The courses that satisfy the concentration requirements can be chosen from a list of approved courses maintained by the graduate program office.		6
Electives		
Students will also complete 6 credits of elective courses. A list of elective courses approved to count towards the degree requirements will be maintained by the program office.		6
Culminating Experience		
BA 865	Strategic Leadership (Capstone Course)	3
Total Credits		28-30

The culminating experience for the degree is a capstone course, BA 865 Strategic Leadership, that provides an opportunity for students to apply and integrate the knowledge and skills that were gained throughout the SMEXL program.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate

student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Contact

Campus	World Campus
Graduate Program Head	Vilmos Misangyi
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Albert Vicere
Program Contact	Michelle Kristen Rockower mkk114@psu.edu (814) 865-5290
Program Website	View (https://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-strategic-management-and-executive-leadership-masters/overview/)

Supply Chain Management

Graduate Program Head	Kevin Linderman
Program Code	SCM
Campus(es)	University Park (M.S.C.M.) World Campus (M.S.C.M.)
Degrees Conferred	Master of Supply Chain Management (M.S.C.M.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=SCM)

The Master of Supply Chain Management in Supply Chain Management (M.S.C.M.) is awarded to students who demonstrate mastery of the knowledge, problem-solving competencies, and leadership skills that are critical to leading business transformation through integrated supply chain planning and execution. The program emphasizes problem-based learning coupled with integrative, collaborative learning experiences to develop the requisite knowledge, skills, and abilities for effective supply chain management.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Admission to the graduate program in Supply Chain Management requires:

- A completed online Graduate School Application for Admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>), including

- Short admissions questions and responses
- Three professional references with complete contact information
- Résumé reflecting relevant experience
- Official transcripts from all post-secondary institutions attended (<http://gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>).

GMAT and/or GRE scores will not be required for admission. Accordingly, these scores will not be accepted.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of Supply Chain Management (M.S.C.M.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students earn the M.S.C.M. degree by successfully completing a minimum of 30 credits including 24 credits of required courses and 6 credits of approved electives.

Code	Title	Credits
Required Courses		
SCM 830	Supply Chain Analysis	3
SCM 800	Supply Chain Management	3
SCM 801	Supply Chain Performance Metrics and Financial Analysis	3
SCM 822	Supply Management	3
SCM 842	Operations Management and Demand Fulfillment	3
SCM 846	Emerging Topics in Supply Chain Management	3
SCM 860	Supply Chain Transformation and Innovation	3
Electives		
Elective credits can be chosen from a list of approved courses maintained by the graduate program office.		6
Culminating Experience		
SCM 850	Supply Chain Design and Strategy (Capstone Course) ¹	3
Total Credits		30

¹ Students must complete a culminating supply chain simulation multi-stage exercise for the degree, while enrolled in the capstone course, SCM 850. The simulation demonstrates the student's ability to apply advanced supply chain management knowledge to a supply chain-related problem or situation in a way that makes a substantial contribution to the student's professional development.

The program requires a cumulative grade point average of at least 3.00 and no course grade below a C. All requirements for the M.S.C.M. degree must be met within eight years of admission to degree status. Students are expected to make continuous progress toward the degree. Leaves of

absence, however, may be granted under exceptional circumstances on a case-by-case basis, at the discretion of the program.

Credits earned at other institutions but not used to earn a degree may be applied toward the requirements for a graduate degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>).

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

Refer to the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students in this program are not eligible for graduate assistantships.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Supply Chain Management (SCM) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/scm/>)

Learning Outcomes

1. **KNOW:** Students will demonstrate a rigorous understanding of the breadth and depth of supply chain management knowledge, including how cross-functional business skills are necessary for sound business processes.
2. **APPLY/CREATE:** Students will apply supply chain management knowledge using relevant models and frameworks representing

current best practices, including those addressing the risks of global supply chains and international trends that affect both domestic and global supply chains.

- 3. COMMUNICATE:** Students will demonstrate their ability to formulate and articulate supply chain ideas individually and collaboratively in written and presentation form.
- 4. THINK:** Students will demonstrate problem-solving skills through case analysis activities (descriptive) and utilizing analytic techniques (predictive) to maintain efficient supply chain practices.
- 5. PROFESSIONAL PRACTICE:** With a focus on ethical and sustainable behavior, students will demonstrate their ability to be a principled leader as well as a valuable team member.

Contact

Campus	University Park
Graduate Program Head	Kevin Linderman
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	David J Huff
Program Contact	Andrea Lyn Murphy-Faust alm205@psu.edu (814) 863-0474
Campus	World Campus
Graduate Program Head	Kevin Linderman
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	David J Huff
Program Contact	Michelle Kristen Rockower 220 Business Building University Park PA 16802 mkk114@psu.edu (814) 865-5290
Program Website	View (http://supplychain.smeal.psu.edu/)

Systems Engineering

Graduate Program Head	Raghu Sangwan
Program Code	SYSEN
Campus(es)	Great Valley (M.Eng.) World Campus (M.Eng.)
Degrees Conferred	Master of Engineering (M.Eng.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=SYSEN)

The newly-redesigned Master of Engineering in Systems Engineering at Penn State Great Valley is intended for today's professional—to fit the needs of busy working adults who are balancing career and life. Courses are either fully online or a 50/50 online/in-person hybrid, combining the personal connection with instructors and intimate classroom setting of in-person education with the flexibility of online learning. This program is STEM designated.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to

Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Admission to the M.Eng in Systems Engineering program will be based on baccalaureate academic records, applicable work experience, and two letters of recommendation from a previous professor or supervisor who can attest to the applicant's academic potential. Applicants with an undergraduate degree in a quantitative discipline such as science or engineering may apply. Students from other disciplines will be considered based on prior course work and/or standardized test scores. Normal admission requirements include two semesters of calculus (Calculus 1 and Calculus 2). Applications must include a statement of professional goals and a curriculum vitae or resume. Test scores from the GMAT or GRE exams are not required. An undergraduate cumulative grade-point average of 3.0 or better on a 4.0 scale in the final two years of undergraduate studies is required.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of Engineering (M.Eng.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The M. Eng. in Systems Engineering degree is conferred upon students who earn a minimum of 36 credits of course work while maintaining an average grade-point average of 3.0 or better in all course work, including at least 18 credits at the 500 or 800 level (with at least 6 credits at the 500 level). The program curriculum includes 18 credits of core courses, 15 credits of electives, and 3 credits of capstone experience.

Code	Title	Credits
Required Courses		
SYSEN 520	Systems Engineering	3
SYSEN 522	Systems Verification Validation & Testing	3
SYSEN 532	Simulation in Systems Engineering: Discrete-Time Systems	3
SYSEN 534	Simulation in Systems Engineering: Continuous-Time Systems	3
SYSEN 880	Systems Architecture and Models	3
SWENG 586	Requirements Engineering	3

Electives

An additional 15 credits of elective courses must be selected from a list of approved elective courses maintained by the graduate program office. 15

Culminating Experience

All students will complete their program of study with a capstone project that provides students with an opportunity to apply their knowledge of the systems engineering theories, methods, processes, and tools learned throughout their program, in a culminating and summative experience. Students complete the capstone project while enrolled in SYSEN 894. 3

Total Credits

36

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Refer to the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students in this program are not eligible for graduate assistantships.

Financial aid for students in on-campus programs is in the form of student loans and a limited number of small scholarships, as described on the Penn State Great Valley website (<https://greatvalley.psu.edu/tuition-and-financial-aid/>).

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Systems Engineering (SYSEN) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/sysen/>)

Learning Outcomes

- KNOW.** Develop heterogeneous engineered solutions to complex problems using contemporary methods, processes, and tools.
- CRITICAL THINKING.** Understand system interdependencies to analyze the associated tradespaces these generate to identify optimal solution alternatives.
- PROBLEM SOLVING.** Use integrated models and simulations for multi-level system analysis and practices.
- APPLY.** Manage the budgets and schedules of large-scale projects and programs while delivering.

- TEAMWORK.** Work effectively and collaboratively within interdisciplinary teams.

Contact

Campus	Great Valley
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Nil Hande Ergin
Program Contact	MICHELLE WHALEN Penn State Great Valley 30 East Swedesford Road Malvern PA 19355 mmw6441@psu.edu
Program Website	View (http://greatvalley.psu.edu/academics/masters-degrees/systems-engineering/)

Campus	World Campus
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Nil Hande Ergin
Program Contact	MICHELLE WHALEN Penn State Great Valley 30 East Swedesford Road Malvern PA 19355 mmw6441@psu.edu
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/systems-engineering-masters/overview/)

Taxation

Graduate Program Head	Henock Louis
Program Code	TAX
Campus(es)	World Campus (M.Tax.)
Degrees Conferred	Master of Taxation (M.Tax.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=TAX)

The Master of Taxation program will prepare graduates to stand out in a competitive job market by studying at a highly reputed business school with some of the world's leading academic thinkers and industry experts. This program will provide students with the knowledge of tax law and policy. The learning outcomes will be achieved by a combination of lectures by faculty, invited guest lecturers, reading of key literature, individual and team projects, and practical involvement in a leadership culminating experience.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate->

admissions/how-to-apply/). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

A completed online Graduate School Application for Admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) is required, including

- Statement of purpose: a 2-3 page essay articulating career and educational goals
- Résumé reflecting relevant experience
- Official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>).
- Additional information may be requested by the program.

GMAT and/or GRE scores will not be required for admission. Accordingly, these scores will not be accepted.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

A minimum of 30 credits at the 400, 500, or 800 level is required, with a minimum of 18 credits at the 500 or 800 level.

CORE COURSES (21 credits)

The core Taxation courses are designed to teach students to think more strategically, assess external trends, learn from exemplar organizations, and enhance their ability to function in today's business environment.

Code	Title	Credits
Required Courses		
ACCTG 812	TAXATION	3
ACCTG 822	Corporate Taxation and Financial Reporting	3
ACCTG 823	Taxation of Pass-Through Entities	3
ACCTG 801	Tax Law and Policy	3
ACCTG 826	International Taxation	1.5
ACCTG 827	State and Local Taxation	1.5
ACCTG 802	Topics in Corporate and Tax Law	3
Electives		
Students will also complete 9 credits of elective courses. A list of elective courses approved to count towards the degree requirements will be maintained by the program office.		9
Culminating Experience		
ACCTG 829	Tax Research and Analysis	3
Total Credits		30

Culminating Experience

The culminating experience for the degree is a capstone course, ACCTG 829 (3 credits), that provides an opportunity for students to apply

and integrate the knowledge and skills that were gained throughout the program.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Solid Tax Foundation

MTax graduates will acquire technical competence in multiple areas of the tax law.

Learning Objectives:

- MTax graduates will acquire in-depth understanding of tax authority, including law, regulations and court cases in a number of taxation areas.
- MTax graduates will demonstrate knowledge of tax policy and procedure as well as how the IRS interprets/applies laws.

2. Tax Analysis

Learning Objectives:

- MTax graduates will develop the ability to analyze and resolve complex tax matters, through issue identification, research, and application of the law to specific facts.

- MTax graduates will develop the skills and knowledge to systematically and analytically provide tax planning and recommendations.

3. Communication

MTax graduates will be able to effectively communicate tax research results and strategies.

Learning Objectives:

- MTax graduates will develop skills needed to present written research results and recommendations in the form of case briefs, memos and letters for both clients and management.
- MTax graduates will learn to orally communicate tax well-reasoned research results and recommendations to individuals and groups.

4. Ethical Responsibilities

MTax graduates will be attuned to the ethical responsibilities of a tax professional in today's society.

Learning Objectives:

- MTax graduates will learn to apply laws, ethical principles, and professional standards in order to evaluate situations and make moral decisions.
- MTax graduates will cultivate a principled approach to leadership, valuing others' perspectives and acting with integrity.

Professional Licensure/Certification

Many U.S. states and territories require professional licensure/certification to be employed. If you plan to pursue employment in a licensed profession after completing this program, please visit the Professional Licensure/Certification Disclosures by State (<https://www.psu.edu/state-licensure-disclosures/>) interactive map.

Contact

Campus	World Campus
Graduate Program Head	Henock Louis
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Lawrence Friedken
Program Contact	Michelle Kristen Rockower mkk114@psu.edu (814) 865-5290
Program Website	View (https://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-taxation-masters-degree/)

Teaching and Curriculum

Graduate Program Head	Raffy Luquis
Program Code	TC
Campus(es)	Harrisburg (M.Ed.) York (M.Ed.)
Degrees Conferred	Master of Education (M.Ed.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=TC)

The Master of Education in Teaching and Curriculum is designed to enhance the skills of teachers for public and private schools.

The program focuses on four components essential to effective teaching – learning, curriculum, instruction, and assessment.

The Teaching and Curriculum program is unified by its vision of critical thinking, democracy, diversity, lifelong learning, nurturance, and scholarship. Courses are designed to reflect the National Board for Professional Teaching Standards (NBPTS). The program is offered at Penn State Harrisburg and available to other campuses.

Pennsylvania Department of Education (PDE) certification and certificates and other specialization programs can be pursued in conjunction with the Teaching and Curriculum Master's degree program in:

- special education,
- English as a second language,
- instructional coaching,
- math coaching,
- principalship,
- secondary education,
- Capital Area National Writing Project, and
- early childhood director's credential.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The M.Ed. Program in Teaching and Curriculum has four important admission requirements.

First, applicants must have achieved an overall junior/senior grade point average of 3.00 or higher. For applicants applying for admission who have completed credits beyond the baccalaureate degree, we will evaluate the last (approximately) 60 credits completed.

Second, applicants must submit two letters of recommendation. These letters must be from former professors or professionals who can attest to the academic ability and potential of the applicant.

Third, applicants must submit a 200-300 word personal statement that addresses their career goals and reasons for pursuing a graduate degree.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students

(<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of Education (M.Ed.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students must maintain a minimum 3.00 grade point average in courses approved by the program, satisfactorily complete all required key assessments, attain a grade "C" or better in all required core courses. Students who do not make satisfactory progress will be notified in writing noting the specific deficiencies and requesting that they meet with the program coordinator to develop a remediation plan. Failure to meet or to satisfactorily complete the remediation plan will result in termination from the program.

In compliance with the National Council for the Accreditation of Teacher Education (NCATE) requirements, all persons enrolled in Teacher Education Programs at Penn State Harrisburg are expected to demonstrate the professional dispositions that are aligned with the unit's vision statement. The faculty shall evaluate the approved dispositions demonstrated by the students in class and during field experiences. Students may be rated as exemplary, acceptable, or unacceptable. Students are expected to attain acceptable or exemplary ratings in order to graduate.

The Master of Education degree in Teaching and Curriculum provides students with two alternatives to meet the required culminating or capstone experience:

1. course work with a master's project (EDUC 587) or
2. course work that includes a capstone course (EDUC 591).

Students may complete the degree requirements for either of the two alternatives with the approval of their adviser.

A total of 30 credits must be completed: 18 credits in core courses and 12 credits in electives. At least 18 credits must be at the 500 or 800 level. A minimum grade-point average of 3.00 for work done at the University and acceptable or higher ratings on the professional dispositions are required for graduation.

Code	Title	Credits
Required Courses		
EDUC 820	Learning Theory for the Classroom	3
EDUC 806	Curriculum Development and Instructional Design (early childhood only)	3
or EDUC 403	Curriculum for Early Childhood	
EDUC 839	Educational Assessment (early childhood only)	3
or EDUC 404	Young Children's Behavior: Observation and Evaluation	
EDUC 805	Curriculum Foundations	3
EDUC 586	Educational Research Designs	3

Electives

Students are required to take up to 12-15 credits of elective course work. Students may take all of those credits in education or, with the approval of their adviser, select up to 9 credits of electives in a field other than education.

Culminating Experience

Select one of the following two alternatives for the culminating experience:	3
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Master's Project (EDUC 587)	
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Capstone Course (EDUC 591)	
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Total Credits	30
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Credits earned at other institutions but not used to earn a degree and credits earned as a non-degree student prior to admission to the graduate program may be applied toward the requirements for a graduate degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>).

Language Arts Option

The goal of the language arts option is to provide students an in depth understanding of:

- how research in theory in the language arts are related to language acquisition and growth;
- the knowledge and skills necessary for conducting informal assessments in the language arts and required to implement a variety of instructional procedures for the language arts;
- and an awareness of the role that literature can have in an effective language arts program at any level.

Mathematics Education Option

The objective of the mathematics education option is to provide courses that will emphasize current research and curriculum shifts related to the teaching of mathematics in K - 12 classrooms. This option requires completion of four EDMTH courses (a total of 12 credits) in addition to the other program requirements:

Code	Title	Credits
Required Courses		
EDMTH 441	Geometry and Measurement Across the K-12 Curriculum	3
EDMTH 442	Algebra and Functions Across the K-12 Curriculum	3
EDMTH 443	Data Analysis and Probability Across the K-12 Curriculum	3
EDMTH 444	Numbers and Operations Across the Curriculum	3
Total Credits		12

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)

- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Education (EDUC) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/educ/>)

Learning Outcomes

1. Employ effective communication skills with school-aged students, parents, co-workers, and administrators.
2. Apply their enhanced ability to provide instruction and utilize materials and content in intellectual and emotional climates for learning.
3. Select and use a variety of educational assessment techniques.
4. Analyze, synthesize, and evaluate educational literature and research and demonstrate competency as a teacher-researcher.
5. Evaluate major issues and current trends in instructional curriculum practice and development.
6. Adopt a critical thinking approach to instructional practices to provide meaningful and relevant learning experiences for all students.
7. Engage in scholarship that informs and guides their professional knowledge and practice.
8. Advocate for equity and social justice in the school and community.
9. Endeavor to undertake continual learning opportunities and growth in their educational community.

Contact

Campus	Harrisburg
Graduate Program Head	Raffy Reinaldo Luquis
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Karin M Sprow Forte
Program Contact	Deborah Louise Klugh Olmsted Building, W331 777 West Harrisburg Pike Middletown PA 17057 dlk33@psu.edu (717) 948-6213
Program Website	View (https://harrisburg.psu.edu/behavioral-sciences-and-education/teacher-education/master-education-teaching-and-curriculum/)
Campus	York
Graduate Program Head	Raffy Reinaldo Luquis
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Karin M Sprow Forte
Program Contact	Deborah Louise Klugh Olmsted Building, W331 777 West Harrisburg Pike Middletown PA 17057 dlk33@psu.edu (717) 948-6213
Program Website	View (https://harrisburg.psu.edu/behavioral-sciences-and-education/teacher-education/master-education-teaching-and-curriculum/)

Teaching English as a Second Language

Graduate Program Head	Tommaso Milani
Program Code	TESL
Campus(es)	University Park (M.A.)
Degrees Conferred	Master of Arts (M.A.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=TESL)

The M.A. program in Teaching English as a Second Language is designed to provide professional development for teachers and administrators in English as a second or foreign language. The program is problem focused, integrating theory and practice from the fields of applied linguistics and teaching English as a second language to address issues of second language acquisition/teaching and program development, with special focus on English in a wide range of both domestic and international contexts.

Completion of this degree program does not automatically provide teacher certification in the Commonwealth of Pennsylvania. Further information on teaching certification is available from the College of Education. Students who desire to continue their studies in ESL at Penn

State may apply to the Ph.D. program in Applied Linguistics through the Department of Applied Linguistics.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Scores from the Graduate Record Examinations (GRE) are required for admission.

All applicants are also required to arrange for three letters of reference to be submitted along with a one- to two-page statement written by the applicant describing the applicant's goals and professional objectives.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Applicants to the Teaching English as a Second Language graduate program must have a minimum TOEFL score of 100 with a 23 on the speaking section for the Internet-based test (iBT), or 600 for the paper-based test. The minimum acceptable composite score for the IELTS for applicants is 7.0.

Degree Requirements

Master of Arts (M.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The department offers two paths to the MA/TESL. Students may complete the entire program in residence at University Park, or they may pursue a hybrid path to the degree, including 12 credits of 800-level online courses, followed by 24 credits (plus M.A. paper and teaching e-portfolio) in residence at University Park. Students pursuing the residential path to the degree may also take the department's 800-level online offerings, and these count as electives in their program of study.

The M.A. in TESL requires 36 credits, of which 18 credits must consist of 500-level courses. In lieu of a thesis, students must prepare a M.A. paper and compile a teaching e-portfolio.

Code	Title	Credits
Required Courses		
<i>Foundations</i>		
APLNG 484	Discourse-Functional Grammar	3
APLNG 491	Theory: Second Language Acquisition	3
APLNG 493	Teaching English as a Second Language	3
<i>Professional Core</i>		
6 credits from among the following:		6
APLNG 410	Teaching American English Pronunciation	
APLNG 412	Teaching Second Language Writing	
APLNG 482Y	Introduction to Applied Linguistics	

APLNG 583 Methods of Language Assessment (required in the Hybrid Path)

<i>Field Experience</i>		
APLNG 500	Practice Teaching in ESL	3
APLNG 595	Internship	3
<i>Research Methods</i>		
3 credits from among the following:		3
APLNG 577	Language Analysis	
APLNG 581	Discourse Analysis	
APLNG 582	Seminar in Approaches to Language Use	
APLNG 586	Analyzing Classroom Discourse	
APLNG 592	Qualitative Research in Applied Linguistics	
APLNG 593	Experimental Research on Language	

Electives

12 credits from among the following:		12
APLNG 510	Health and Aging in Multilingual Contexts	
APLNG 512	Language and Adult Lifespan Development	
APLNG 570	Second Language Reading	
APLNG 572	Communication in Second Language Classrooms	
APLNG 575	Language Ideology	
APLNG 576	Language Socialization across Home, School, and Community Contexts	
APLNG 584	Sociocultural Theory and Second Language Learning	
APLNG 587	Theory & Research in L2 Teacher Education	
APLNG 588	Design and Research of Technology-Mediated Language Learning	
APLNG 589	Technology in Foreign Language Education: An Overview	
APLNG 591	Seminar in Second Language Acquisition	
Other courses with approval of the adviser		

Culminating Experience

All students must also complete an M.A. paper and teaching e-portfolio.

Total Credits **36**

Residential Path

With guidance from their advisers, students who are enrolled in the Residential Path take 12 credits in electives. Any 500-level 3-credit course not taken as a requirement of Research Methods can be counted as an elective in the resident MA/TESL program.

Resident Path students are allowed to take any or all of the APLNG 800-level courses as electives in any sequence during the MA/TESL program. If 12 credits of APLNG 800-level courses are taken, resident path students are required to take APLNG 583 and, in consultation with their academic adviser, substitute two 500-level electives (6 credits) for appropriate courses listed under Foundations and/or Professional Core.

Hybrid Path

Students who choose to take the hybrid path to the degree will have already taken APLNG 802, APLNG 804, APLNG 806, and APLNG 808 online, and these online courses take the place of the 12 credits of elective courses. Hybrid path students are required to take APLNG 583 and, in consultation with their academic advisers, substitute two

500-level electives (6 credits) for appropriate courses listed under Foundations and/or Professional Core.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Applied Linguistics (APLNG) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/aplng/>)

Learning Outcomes

- Graduates will be able to design and evaluate instructional materials, technology, media, and other resources that meet the specific instructional and language related needs and abilities of students.
- Graduates will be able to reflect on, critically analyze, and evaluate their teaching practices.
- Graduates will be able to articulate a philosophy of language teaching grounded in current language and learning theories.
- Graduates will be able to critically evaluate the complex social, cultural, political, and institutional factors that affect language teaching and students' language learning.
- Graduates will be able to articulate an understanding of the research and research methods for studying language teaching and learning.

- Graduates will be able to demonstrate knowledge of the teaching field (English as a Second Language).
- Graduates will be able to participate effectively in collaborative projects with others.

Contact

Campus	University Park
Graduate Program Head	Tommaso M Milani
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Celeste S Kinginger
Program Contact	Nicole Marie Schwindenhammer 234 Sparks Building University Park PA 16802 nmf119@psu.edu (814) 867-4284
Program Website	View (http://aplng.la.psu.edu/programs/m-a-tesl-degree/)

Theatre

Graduate Program Head	Rick Lombardo
Program Code	THEA
Campus(es)	University Park (M.F.A.)
Degrees Conferred	Master of Fine Arts (M.F.A.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=THEA)

The master of fine arts degree program in Theatre pursues the following objectives:

- to assist each student in acquiring discriminating taste and critical judgment in theatre;
- to help each student attain skills and proficiencies in theatre;
- to provide the training, discipline, and opportunities essential to the development of a professional ability in at least one area of theatre; and
- to prepare each student for an active career in academic and/or professional theatre or other areas within the entertainment industry.

Facilities include the Playhouse, a 450-seat proscenium theatre; the Pavilion, a 249-seat thrust theatre; a 150-seat proscenium theatre in the heart of downtown State College; theatre production studios for scenic, property, and costume preparation; two computer-assisted design laboratories; a lighting laboratory; a sound and media studio; and rehearsal and dance studios.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Graduate Record Examination (GRE) scores, or comparable examination scores, are not required for admission to the School of Theatre.

Requirements for admission to the M.F.A. program are:

1. a broad undergraduate preparation in theatre, including 3 credits each in acting, directing, stagecraft, and theatre history; and 6 credits of dramatic literature;
2. 12 credits in related subject areas such as communications, oral interpretation, art, business, music, and dance; and
3. submission of a vita and at least three letters of recommendation.

Additional requirements for M.F.A. applicants are:

1. submission of evidence of professional potential in the proposed area of specialization-auditions, prompt books, portfolios, manuscripts, and other appropriate presentations-to the applicable study program(s) by arrangement with the department; and
2. a personal interview to be arranged by the student.

Degree Requirements

Master of Fine Arts (M.F.A.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The program entails specialized professional training in one of the following areas:

- acting,
- directing,
- scene design,
- costume design,
- costuming,
- lighting design, and
- technical direction.

Six semesters in residence are normally required to complete the minimum 60-credit degree.

Students are evaluated on a semester-by-semester basis on academic progress, creative achievement, and professional potential. The M.F.A. is a professional degree and is granted by the Graduate Faculty on the basis of academic and creative excellence over and above the fulfillment of requirements. Satisfactory academic progress does not guarantee continuance in the program, nor does continuance in the program imply the automatic granting of a degree. M.F.A. students are required to participate in the School of Theatre productions in positions of responsibility. Additionally, each student must complete a committee-approved monograph project in the area of specialization. An international residency is required and is funded by the school.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)

- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Theatre (THEA) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/thea/>)

Contact

Campus	University Park
Graduate Program Head	Rick J Lombardo
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Daniel I Robinson
Program Contact	Judy L King 116 Theatre Building University Park PA 16802 jqk5@psu.edu (814) 865-7587
Program Website	View (http://www.theatre.psu.edu)

Transdisciplinary Research on Environment and Society

Graduate Program Head	Carter Hunt
Program Code	TREES
Campus(es)	University Park
Degrees Conferred	Dual-Title
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=TREES)

Students electing the dual-title intercollege program in TREES through participating majors may earn a degree with the dual-title at both the Ph.D. and M.S./M.A. levels, i.e., Ph.D. in (graduate program name) and Transdisciplinary Research on Environment and Society, or M.S./M.A. in

(graduate program name) and Human Dimensions of Natural Resources and the Environment.

The following graduate programs offer dual-title degrees in TREES:

- Anthropology
- Architecture
- Energy and Mineral Engineering
- Forest Resources
- Geography
- Landscape Architecture
- Recreation, Park and Tourism Management
- Rural Sociology

The TREES dual-title intercollege degree program is administered by the TREES Program Committee. The committee maintains program definition, identifies appropriate faculty and courses, and recommends policies and procedures for its operation. This dual-title intercollege degree program is offered through graduate major programs in four colleges Agricultural Sciences, Earth and Mineral Sciences, Health and Human Development, and the Liberal Arts. TREES enables students to attain and be identified with the content, techniques, applications, methods, and policy implications of an interdisciplinary focus on transdisciplinary research on environment and society, while maintaining a close association with areas of application.

Through participation in TREES, student's programs of study will emphasize integrated, multidisciplinary approaches designed for improving their understanding about and management of natural resources. Areas of study will reflect the faculty adviser's home department and disciplinary thrust.

Admission Requirements

To pursue a dual-title intercollege degree under this program, the student must first apply and be admitted through one of the existing graduate programs that offers the dual-title degree in TREES:

- Anthropology
- Architecture
- Energy and Mineral Engineering
- Forest Resources
- Geography
- Landscape Architecture
- Recreation, Park and Tourism Management
- Rural Sociology

Once enrolled in their home degree program, the student can apply to the Admissions Committee of TREES. The TREES admissions committee reviews applications and recommends students for admission to the dual-title degree program to The Graduate School. TREES admission requirements include:

1. a minimum baccalaureate Jr/Sr grade point average of 3.0 out of a 4.0 scale;
2. a statement of professional goals, natural resource management philosophy, and reasons for applying to the program; and
3. a letter of support from the student's doctoral advisor acknowledging the TREES dual title program's requirements and their individual and departmental support of the student's participation in the program.

Doctoral students must be admitted into the dual-title degree program in TREES no later than the end of the fourth semester (not counting summer semesters) of entry into the graduate major program.

Degree Requirements

To qualify for the TREES dual-title intercollege degree, students must satisfy the requirements of the major degree program in which they are enrolled, including the communication/foreign language requirements, if any. In addition, they must satisfy the minimum requirements in the TREES dual-title intercollege program described here. Final course selection, including which courses will satisfy the both the graduate major program and dual-title program requirements, is determined by the students with approval by their dual-title program advisers and their major program advisers. All dual-title intercollege degree candidates should enroll in TREES 590 in their first semester.

A student in TREES must complete 15 credits of TREES course work beyond the bachelor's degree in addition to curricular requirements for the master's or doctoral degree in the student's primary program. These courses are required for both the M.S./M.A. and Ph.D. degrees.

Code	Title	Credits
REQUIRED COURSES		
TREES 590	Colloquium in Transdisciplinary Research on Environment and Society	1
TREES 574	Integrated Perspectives in Transdisciplinary Research on Environment and Society	3
TREES 575	Ethical Issues in Transdisciplinary Research on Environment and Society	3
	Two courses from at least two pools that provide the most breadth for the student as determined by the program chair. A list of courses in each pool is maintained by the graduate program office.	6
TREES 596	Individual Studies (at least 1 credit)	1
	Graduate-level Internship (at least 1 credit at the 495/595/895 level); internship credit can reside in student's home department or related program, but requires approval by the program chair.	1
Total Credits		15

Master's Degrees

All courses, including which courses will satisfy both the graduate major program and dual-title program requirements, must be approved by the student's M.S./M.A. adviser(s) and/or committee. The thesis supervisor and chair of the student's committee shall be a member of the student's major program, and a member of the dual-title program. All members of the committee must hold Graduate Faculty status or secure the same before serving on the committee.

The culminating experience (e.g., thesis or scholarly paper or capstone course) must incorporate a TREES interest together with the primary field of study.

Doctoral Degrees

All courses, including which courses will satisfy both the graduate major program and dual-title program requirements, must be approved by the student's dissertation adviser(s) and/or committee.

Doctoral students must be admitted into the dual-title graduate degree program no later than the end of the fourth semester (not counting summer semesters) of entry into the graduate major program. In consultation with the TREES dual-title program, the graduate major

program will determine the timing and format of the Qualifying Examination for dual-title TREES students from the three available options: a single qualifying examination that covers both the major and the dual-title, separate qualifying examinations for the major field and the dual-title field, or a qualifying examination in just the major field. This will be stated in the graduate major program's Graduate Bulletin listing for the dual-title adoption.

In accordance with Graduate Council policy (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>), the Ph.D. committee must include at least one Graduate Faculty member from TREES. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in TREES, the member of the committee representing TREES must be appointed as co-chair. The TREES representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

All Ph.D. students will be required to complete, present, and defend a dissertation that incorporates a topic related to both their graduate major program and TREES. Candidates for the dual-title Ph.D. degree in TREES will be required to pass a final oral examination (the dissertation defense) covering their graduate major program field and TREES. To earn the Ph.D. degree, doctoral students must also write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Transdisciplinary Research on Environment and Society (TREES) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/trees/>)

Learning Outcomes

1. Frame a problem from multiple social, temporal, and cultural perspectives and evaluate alternative solutions (design-thinking)
2. Analyze the interactions, boundaries, components, and identities of social-ecological systems and how they might change through time and across space (systems thinking)
3. Effectively communicate and engage with diverse audiences (communication)
4. Facilitate collective action through development of intentional group agency (team facilitation)
5. Recognize the importance of different value systems in multiple societal and cultural contexts (ethical dimensions)
6. Identify creative solutions by taking risks and integrating knowledge (innovation)
7. Demonstrate proficiency in one discipline and emergent skills in another (interdisciplinary proficiency)

Contact

Campus	University Park
Graduate Program Head	Carter Hunt
Program Contact	Carter Hunt cah59@psu.edu (814) 863-9773

Turfgrass Management

Graduate Program Head	Benjamin McGraw
Program Code	TURFM
Campus(es)	World Campus (M.P.S.)
Degrees Conferred	Master of Professional Studies (M.P.S.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=TURFM)

The Master of Professional Studies in Turfgrass Management is a terminal master's degree program that emphasizes a systems approach to turfgrass management. The program balances theory and practice. Courses taught in the program use web-based lessons, quizzes, exams, and team projects and exercises to provide a balance between individualized study and interactive learning. Individuals who currently work as managers of turfgrass facilities, including golf courses and professional sports complexes, would benefit from this program.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Applicants must submit a letter of professional introduction in which they describe their professional experiences and education, delineate their career goals, and discuss how the program will enable them to meet their objectives. Applicants must also provide two letters of reference and recommendation. The best-qualified applicants will be accepted up to the number of spaces that are available for new students.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Degree Requirements

Master of Professional Studies

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The professional master's degree requires 30 credits at the 400, 500, or 800 level, including a final integrative project. A total of 18 credits must be 500 or 800 level, with at least 6 credits of 500-level course work; this Graduate Council requirement is met through the required courses, the capstone project, and at least one 500-level elective course.

Code	Title	Credits
Required Courses		
TURF 850	Turfgrass Physiology	3
AEPS 851	Applied Plant Population Biology	3
TURF 852	Turfgrass Health Management	3
TURF/PPATH 853	Interpreting Turfgrass Science Literature	3
Electives		
	In consultation with their adviser, students also take an additional 15 credits of elective coursework from a list of approved elective courses maintained by the graduate program office to focus on their particular interest within turfgrass facility management.	15
Culminating Experience		
AGRO 596	Individual Studies (Capstone Project)	3
Total Credits		30

The program culminates with a capstone project which is completed while the student is enrolled in AGRO 596 Individual Studies. In this integrative capstone project, the student demonstrates the capability to integrate and apply concepts, principles, analytical techniques, and interpretation skills learned in the program to a real problem faced in turfgrass facility management.

Transfer Credits

If students have successfully completed courses from another institution that are equivalent to the elective turfgrass courses, these can be applied toward satisfying the M.P.S. degree requirements, subject to restrictions

outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>).

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (<https://www.worldcampus.psu.edu/tuition-and-financial-aid/>) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Turfgrass (TURF) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/turf/>)

Learning Outcomes

- KNOW:** Graduates will demonstrate a working knowledge of the core concepts and major scientific issues related to turfgrass science. Graduates will exhibit breadth and depth of understanding in their discipline via courses completed in the M.P.S. program and through their final project.
- APPLY/CREATE:** Graduates will demonstrate the ability to apply scientific concepts and significant research findings to real-world problems. They will be able to integrate research findings and practical knowledge of turfgrass science and design appropriate methodologies to address problems in the field. The demonstration of these skills will include frequent essay exams where newly acquired concepts must be applied to a unique set of circumstances. This set of skills will also be demonstrated in the student's final project which requires a broad analysis of a particular issue facing the industry.

3. **COMMUNICATE:** Graduates will be able to inform the decision-making process by effectively communicating the application of particular scientific concepts, technical knowledge, and research findings. Graduates will be able to effectively convey this information to lay persons and peers in the discipline.
4. **THINK:** Graduates will be able to define, conceptualize, and critically analyze a turfgrass management problem and possible solutions considering the scientific, economic, and political circumstances using knowledge and practice gained in the program.
5. **PROFESSIONAL PRACTICE:** Graduates of the program will demonstrate the ability to collaborate in a collegial manner and demonstrate high ethical standards, values, and best practices. This will be demonstrated through varying group projects and open discussions surrounding controversial issues in turfgrass science.

Contact

Campus	World Campus
Graduate Program Head	Benjamin A McGraw
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Benjamin A McGraw
Program Contact	Dianne Marie Petrunak 116 ASI Building University Park PA 16802 dmp6@psu.edu (814) 863-0139
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/turfgrass-management-masters/overview/)

Visual Studies

Graduate Program Head	Christopher Reed
Program Code	VSTUD
Campus(es)	University Park
Degrees Conferred	Dual-Title
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=VSTUD)

Students electing this program through partnering departments earn a degree with a dual-title at the Ph.D. level, i.e. Ph.D. in (graduate program name) and Visual Studies.

The dual-title Ph.D. in Visual Studies fosters an interdisciplinary approach to humanistic study, which, spurred by technological dynamics that increasingly integrate text and image, engages analysis of specific images, physical and virtual environments, and visual sign systems; histories of visual modes of communication, apprehension, and aesthetic pleasure; and conceptions of the nature of visuality itself. Students in this program analyze and assess visual media that, integrated with texts, are integral to humanistic scholarship and pedagogy today. Dual-title degree programs increase the intellectual rigor and breadth of graduate work and provide a context in which students learn to synthesize knowledge within and across disciplinary boundaries in both scholarship and teaching. Drawing from knowledge and practices produced across the humanistic disciplines while responding to ongoing challenges to conventional disciplinary boundaries, this degree highlights existing

strengths of graduate training in the humanities at Penn State, structures the continuing development of these programs, and credentials our graduates' training and work with visual forms, environments, and media.

Admission Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Students must apply and be admitted to their primary graduate program and The Graduate School before they can apply for admission to the Visual Studies dual-title degree program. Applicants interested in the dual-title degree program may make their interest known on their applications to their primary graduate program, and should ensure their personal statements reflect their interest in the Visual Studies dual-title graduate program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Visual Studies dual-title program. Doctoral students must be admitted into the dual-title degree program in Visual Studies prior to taking the qualifying examination in their primary graduate program.

With the approval of the Director of Graduate Studies in their primary graduate program, students already enrolled in a co-operating graduate program at Penn State may apply to the Visual Studies program after they are admitted as graduate students in their primary graduate programs. Applicants must submit the following materials to the Visual Studies Academic Advisory Committee, which will determine admission to the program:

- A letter of approval from the Director of Graduate Studies in your primary graduate program
- A copy of your Graduate School Application which was originally submitted to your primary graduate program
- Official transcripts from previous coursework, including transcripts that accompanied application to the Graduate School and transcripts of coursework completed at Penn State (Photocopies of transcripts sent from the home department are acceptable)
- Official GRE scores (Photocopies of GRE scores sent from the home department are acceptable)
- A writing sample
- A personal statement that describes how the dual degree program fits with your scholarly interests
- 1 letter of recommendation from a Visual Studies faculty member at Penn State

Degree Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

To qualify for the dual-title degree, students must satisfy the requirements of their primary graduate program. In addition, they must satisfy the requirements described below, as established by the Visual Studies dual-title degree program.

The minimum course requirements for this dual-title Ph.D. degree are as follows:

- 15 credits of course work related to Visual Studies, all at the 500- or 800-level. In certain circumstances, a 400-level course may be substituted with the approval of the Director of the Visual Studies graduate program and the student's adviser. Such approval must be granted in writing before the course is taken and will require work supplementing the syllabus, such as a culminating research paper. Of the 15 credits required for the Visual Studies dual-title, 6 must come from the two required core courses in the Visual Studies program: VSTUD 501 and VSTUD 502.
- Students must also take 9 elective credits from courses approved by the Visual Studies Academic Advisory Committee. In order to promote interdisciplinarity, at least 3 of these credits must be from a college, department, or program outside the student's home department or program. Students may complete the courses contributing to the Visual Studies degree in any sequence.

A list of courses approved to count towards the Visual Studies dual-title degree requirements will be maintained by the program office.

Qualifying Examination

The dual-title field will be fully integrated into the qualifying exam for the doctoral program. The qualifying examination committee for the dual-title Ph.D. degree must include at least one Graduate Faculty member from the Visual Studies program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. In addition, students in the dual-title Ph.D. degree program in Visual Studies will be required to present to their qualifying examination committee a portfolio of work in Visual Studies, including:

- a statement of the student's interdisciplinary research interests,
- a program plan, and
- samples of writing that indicate the student's interest in questions related to the Visual Studies.

Because students must first be admitted to a graduate major program of study before they may apply to and be considered for admission into a dual-title graduate degree program, dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

Ph.D. committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Visual Studies dual-title doctoral degree student must include at least one member of the Visual Studies Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the committee chair does not represent Visual Studies, the committee member representing Visual Studies must be appointed as co-chair.

Comprehensive Exam

After completion of required course work, doctoral students in the dual-title doctoral degree program must pass a comprehensive examination. The Visual Studies Graduate Faculty member on the candidate's committee is responsible for developing and administering the Visual Studies portion of the student's comprehensive exam. The exam must incorporate written and oral components addressing Visual Studies based on the student's areas of interest and specialization in Visual Studies.

Dissertation and Final Oral Examination

The candidate must complete a dissertation on a topic that reflects his or her original research and education in both the primary graduate program and Visual Studies. In order to earn the dual-title Ph.D. degree, the dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School, and the student must pass a final oral examination (the dissertation defense).

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Visual Studies (VSTUD) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/vstud/>)

Contact

Campus	University Park
Graduate Program Head	Chris Reed
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Daniel Leonhard Purdy
Program Contact	Chris Reed cgr11@psu.edu (814) 865-4242
Program Website	View (http://www.visualstudies.psu.edu/)

Wildlife and Fisheries Science

Graduate Program Head	Margot Kaye
Program Code	WFS
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.)
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=WFS)

Programs are designed to give students an understanding of the biology and management of terrestrial or aquatic wildlife species and their environments, and include training in fish and wildlife ecology, nutrition, physiology, behavior, and pathology of wildlife species; study of successional stages, land use, and management of various habitats and their impact on fish and wildlife populations; population dynamics and manipulation of animal numbers; and studies of recreational, aesthetic, and socioeconomic values of fish and wildlife. Most programs of study are strengthened by including appropriate courses offered by related departments.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Application materials should be submitted before February by those who want to begin in summer or fall. For admission, an applicant should have at least a 2.75 grade-point average, a 3.00 junior/senior average, and courses that are basic to the individual's field of specialization. Ordinarily these include:

- 12 credits in communication,
- 12 credits in social sciences and humanities,
- 10 credits in quantification including calculus and statistics,
- 8 credits in chemistry and/or physics,
- 8 credits in biological sciences, and
- 18 credits in fish, wildlife, forestry, or related courses.

Three reference reports (forms supplied on request), and a brief statement describing the applicant's academic goals, career interests, and special qualifications are required. The best-qualified applicants will be accepted up to the number of spaces available. Exceptions

to admission requirements may be made for students with special backgrounds, abilities, and interests.

Admission to the Ph.D. program in Wildlife and Fisheries Science requires a master's degree in wildlife and fisheries science or a closely related field, or a bachelor's degree with a minimum grade-point average of 3.30 and demonstrated research ability.

Degree Requirements

Master of Science (m.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

In addition to Graduate Council requirements, 6 credits of statistics and 2 credits of colloquium are required.

Each entering student receives individual guidance from an adviser, and later from his or her committee, in designing a program of studies and research based on his or her own interests. The student is responsible for conforming to all requirements summarized in the "Graduate Studies Handbook" of the School of Forest Resources, and for completing the degree program within a reasonable time, i.e., two years for a master's degree.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Doctoral students would normally emphasize either wildlife or fisheries in their course selection. Course work shall include at least 15 graduate credits beyond those required for an M.S. in Wildlife and Fisheries Science. At least 9 of these credits must include courses at the 500 level with a Wildlife and Fisheries Science designation.

An international communications or cultural requirement is required for the Ph.D. degree. This requirement may be satisfied by demonstrating competence in one foreign language equivalent to passing two or three college-level courses. It also may be met by two courses in one or two contemporary foreign cultures. With approval of the Ph.D. committee, a student may petition the Graduate Faculty of the school for waiver of the international communications or culture requirement.

Students must pass the qualifying examination during their first year of residence and a comprehensive examination which is given after all course requirements have been completed. The final examination is oral; all doctoral students are required to present a public seminar on their dissertation prior to the final examination.

Each entering student receives individual guidance from an adviser, and later from his or her committee, in designing a program of studies and research based on his or her own interests. The student is responsible for conforming to all requirements summarized in the "Graduate Studies Handbook" of the School of Forest Resources, and for completing the degree program within a reasonable time, i.e., three years for a Ph.D.

Watershed Stewardship Option

The Graduate Option in Watershed Stewardship is intended to provide enhanced educational opportunities for students with an interest in water resources management who are enrolled in a graduate degree program within Wildlife and Fisheries Science. The objective of the Graduate Option in Watershed Stewardship is to educate students to facilitate

team-oriented, community-based watershed management planning directed at water resources problems encountered in Pennsylvania communities, especially nonpoint source water pollution. The Graduate Option in Watershed Stewardship requires 22 credits of graduate course work:

Code	Title	Credits
Select 12 credits of breadth courses ¹		12
FOR 591A & FOR 591B or LARCH 510	Seminar in Watershed Stewardship Issues and Seminar in Watershed Stewardship Planning ² Graduate Seminar in Landscape Architecture	2
Select one of the following sequences:		8
FOR 570 & FOR 571	Watershed Stewardship Practicum I and Watershed Stewardship Practicum II	
LARCH 817 & LARCH 550	Grad Studio III and Master of Landscape Architecture Project Studio	
Total Credits		22

¹ Breadth courses will consist of three graduate credits of course work from each of four subject matter areas:

1. water resources science
2. social science, public policy and economics
3. humanities
4. communications and design

² One credit of FOR 591A or FOR 591B would count as a colloquium course toward degree requirements, but at least 1 additional credit of FOR 590 is required.

In the watershed stewardship practicum courses students work in teams with community, government and business leaders to analyze and understand natural resources problems and creatively synthesize appropriate solutions in the form of a written watershed management plan.

A list of acceptable breadth courses from each discipline is provided in the Graduate Option in Watershed Stewardship Handbook. Students will be allowed to petition to the Center for Watershed Stewardship to substitute higher level or equivalent courses in a major field to suit their specific backgrounds and goals. Courses taken for the Graduate Option in Watershed Stewardship may be used to satisfy other equivalent (400- or 500-level) degree requirements with concurrence of their adviser and Ph.D. committee. The Ph.D. committee for a student enrolled in the Option in Watershed Stewardship must include a faculty representative from the Center for Watershed Stewardship.

Students enrolled in M.S. or Ph.D. degree programs within Wildlife and Fisheries Sciences may apply to participate in the Graduate Option in Watershed Stewardship.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

The following awards typically have been available to graduate students in this program:

Forest Resources: Jesse Rossiter Rapp Memorial Scholarship

Available to graduate students in the School of Forest Resources who are not holding assistantships as graduate students. Apply to the School of Forest Resources' Scholarships, Loans, and Awards Committee.

Roger M. Latham Memorial Award

Awarded to outstanding graduate students specializing in wildlife or fisheries after at least one semester in residence.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Wildlife and Fisheries Science (WFS) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/wfs/>)

Learning Outcomes

Master of Science (m.S.)

1. **KNOW:** Graduates in these three masters programs will have obtained knowledge of core theories and methods as demonstrated by courses completed and grades earned at the bachelor's level. Graduates will exhibit breadth and depth of understanding in their respective disciplines in courses completed at the master's level.
2. **APPLY/CREATE:** Graduates in these three masters programs will be able to clearly synthesize literature and theories in their disciplinary areas and/or in their specialized thesis topics. Such synthesis will help generate new ideas or methods to develop unique solutions to the problems in the three disciplinary programs.

3. **COMMUNICATE:** Graduates in these three masters programs will effectively communicate ideas, arguments, and rationales in clear, concise, well-organized publications (abstracts, papers, proposals) and presentations (conferences, seminars, and research meetings).
4. **THINK:** Graduates in these three masters programs will be able to critically analyze the work of others in their field of specialty. Such analyses will help graduate students to demonstrate proficiency in designing a research strategy to answer important questions and to improve their own work.
5. **PROF. PRACTICE:** Graduates in these three masters programs will demonstrate the highest ethical standards and core values (including Penn State Core Values) within their discipline and other diverse scientific backgrounds.

Doctor of Philosophy (Ph.d.)

1. **KNOW:** Graduates in these three doctoral programs will have obtained the knowledge of the core theories and methods at the bachelors and/or master's levels. Graduates will exhibit breadth and depth of understanding in their respective disciplines in courses completed at the doctoral level.
2. **APPLY/CREATE:** Graduates in these three doctoral programs will be able to clearly synthesize literature and theories in their disciplinary areas and/or in their specialized thesis/dissertation topics. Such synthesis will help generate new ideas or methods to develop unique solutions to the problems in the three disciplinary doctoral programs.
3. **COMMUNICATE:** Graduates in these three doctoral programs will effectively communicate ideas, arguments, and rationales in clear, concise, well-organized publications (abstracts, papers, proposals) and presentations (conferences, seminars, and research meetings).
4. **THINK:** Graduates in these three doctoral programs will be able to critically analyze the work of others in their field of specialty. Such analyses will help graduate students to demonstrate proficiency in designing a research strategy to answer important questions and to improve their own work.
5. **PROF. PRACTICE:** Graduate students in these three doctoral programs will demonstrate the highest ethical standards and core values (including Penn State Core Values) within their discipline and other diverse scientific backgrounds.

Contact

Campus	University Park
Graduate Program Head	Margot Wilkinson Kaye
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Patrick Joseph Drohan
Program Contact	Nicole Marie Houck Dept of Ecosystems Sci Mngmt 319 Forest Resources Building University Park PA 16802 nmh5631@psu.edu (814) 863-7221
Program Website	View (http://ecosystems.psu.edu/graduateprograms/wfs/)

Women's, Gender, and Sexuality Studies

Graduate Program Head	Alicia C. Decker
Program Code	WGSS
Campus(es)	University Park
Degrees Conferred	Dual-Title
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=WGSS)

Students can earn a dual-title master's degree (M.A./ M.S.) or a dual-title Ph.D. in Women's, Gender, and Sexuality Studies (WGSS). All dual-title degrees must be paired and completed simultaneously with a graduate degree in one of our partner programs. These departmental partners are: Art Education; Communication Arts and Sciences; Comparative Literature; Curriculum and Instruction; English; French and Francophone Studies; Geography; History; Mass Communications; Media Studies; Philosophy; Political Science; Psychology; and Rural Sociology. For students outside of these fourteen major degree programs, we offer a graduate minor in Women's, Gender, and Sexuality Studies.

Our dual-title master's and Ph.D. degrees provide students with conceptual, methodological and pedagogical training in the field of Women's, Gender, and Sexuality Studies. Our graduate program embraces intersectional and transnational feminist approaches to knowledge production, pedagogy, and community engagement. Faculty and graduate students in WGSS use interdisciplinary frameworks to research questions that span the arts, humanities, and the social sciences. Because this degree is combined with a master's or Ph.D. from one of our partner departments, students are well-prepared to produce cutting-edge, interdisciplinary scholarship; to teach across both disciplines; and to excel in a career in either field.

Admission Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Students will be considered for admission to the interdisciplinary master's or Ph.D. dual-title programs by the WGSS Graduate Studies Committee. Applicants to the dual-title should have a junior/senior cumulative average of at least 3.00 (on a 4.00 scale) and should have previous course work in Women's, Gender, and Sexuality Studies or in related fields.

Applicants may apply to the dual-title program in two ways:

1. As an "external" candidate. When a student first applies for graduate study at Penn State, they can indicate their interest in a dual-title on the main online graduate application (each department will list its dual-title options). After the major disciplinary program admits a student into its degree program, the interested student's application is forwarded to the WGSS dual-title Graduate Studies Committee for consideration. This student may apply using the same application materials as provided to the disciplinary program and Graduate School. It is *strongly* recommended, however, that a dual-title applicant include in their statement of purpose a discussion of how their research will integrate the partner fields (i.e., the disciplinary major and the interdisciplinary major). Alternatively, the applicant

is encouraged to attach both a separate statement of purpose and a writing sample demonstrating their previous work with and in feminist/gender theory. *Please note: External candidates with little or no previous course work in women's, gender and/or sexuality studies are unlikely to be admitted; in that case, the student is encouraged to take at least one graduate core course in WGSS upon matriculation, and then to (re)apply as an "internal candidate" (see below) after completing at least one core WGSS course.*

- As an "internal" candidate. Current Penn State graduate students pursuing a degree in one of our partner programs can also apply for admission into the dual-title Ph.D. in Women's, Gender, and Sexuality Studies. The application *and official admission* must be completed *before taking qualifying exams*. Internal applications are considered twice per year, with application deadlines on October 15th for fall semester consideration, and February 15th for spring semester consideration. Internal applicants will provide, in addition to their original application materials for graduate study at Penn State: an unofficial Penn State graduate transcript; a statement of purpose addressing research and professional goals that reflect interest and substantive engagement in interdisciplinary and feminist research, theories, and/or methodologies; and a letter of recommendation from a member of the WGSS graduate faculty.

*Important reminder: As noted above, Doctoral students must be admitted into the dual-title degree program in WGSS prior to taking the qualifying examination in their major disciplinary graduate program, and no later than the end of the fourth semester.

Degree Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

To qualify for a dual-title degree, students must satisfy the requirements of the disciplinary graduate program in which they are enrolled, as well as the degree requirements for the interdisciplinary dual-title in Women's, Gender, and Sexuality Studies. WGSS requirements for each degree program are listed below.

Candidates for the dual-title M.A./M.S. degree must complete twelve credits of graduate coursework and write a thesis or scholarly paper that centrally engages the field of Women's, Gender, and Sexuality Studies.

Degree Requirements for the Dual-Title Master's Degree

Code	Title	Credits
Required Courses		
WMNST 502	Global Feminisms	3
WMNST 507	Feminist Theory	3
WMNST 509	Feminist Pedagogies	3
	or WMNST 508 Feminist Methodologies	
3 additional credits of graduate coursework will be completed with prior consultation and approval of the Director of Graduate Studies in WGSS		3
Total Credits		12

Candidates for the dual-title M.A./M.S. degree in Women's, Gender, and Sexuality Studies must have at least one member of the WGSS Graduate Faculty on their master's advising committee.

Degree Requirements for the Dual-Title Ph.D.

To qualify for a dual-title degree, students must satisfy the requirements of the disciplinary graduate program in which they originally enrolled, as well as the degree requirements for the interdisciplinary dual-title in Women's, Gender, and Sexuality Studies.

These requirements include: eighteen credits of graduate coursework and a dissertation that centrally engages the field of Women's, Gender, and Sexuality Studies.

Code	Title	Credits
Required Courses ¹		
WMNST 502	Global Feminisms	3
WMNST 507	Feminist Theory	3
WMNST 508	Feminist Methodologies	3
	or WMNST 509 Feminist Pedagogies	
9 additional credits of elective graduate coursework will be completed with prior approval from the Director of Graduate Studies in WGSS. No more than three credits counting toward elective coursework can be completed at the 400-level, and at least one of the elective courses will be taken in a department other than the student's major degree program.		9
Total Credits		18

¹ Any exceptions to the WGSS degree requirements stated above must be approved by the Director of Graduate Studies.

Qualifying Examination

The qualifying examination committee for the dual-title Ph.D. degree must include two Graduate Faculty members from Women's, Gender, and Sexuality Studies. Faculty members holding appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, with questions from both the disciplinary graduate degree program and from Women's, Gender, and Sexuality Studies. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable (but not past the fourth semester, per Graduate Council policy).

Doctoral Committee Composition

In addition to the general Graduate Council requirements for doctoral committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/doctoral-dissertation-committee-formation/>), all candidates for the Dual-title Ph.D. in Women's, Gender, and Sexuality Studies must have at least two members of the Graduate Faculty of Women's, Gender, and Sexuality Studies on their advising committee. One of these members must serve as chair or co-chair of the doctoral committee, as reflected in Graduate Council requirements for all dual-title Ph.D. programs. In addition, we strongly recommend that at least one of these WGSS-affiliated faculty have their tenure home outside of the student's partner discipline.

Comprehensive Exams

Dual-title Ph.D. students take one combined comprehensive exam that integrates questions from both disciplines. The Women's, Gender, and Sexuality Studies-affiliated faculty members on the student's doctoral committee are responsible for assessing a student's mastery of the following areas: feminist theory, feminist methodologies, global feminisms, and feminist studies in the student's partner discipline.

Doctoral Dissertation And Defense

A dissertation on a Women's, Gender, and Sexuality Studies topic is required of students in the dual-title degree program. That dissertation topic must be approved by the student's Ph.D. committee. Upon researching, writing, and completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense). The dissertation must be accepted by the doctoral committee, the head of both graduate programs, and the Graduate School.

Formal Meetings

Once a Ph.D. committee is appointed, dual-title students must include the WGSS-affiliated advisers in all formal meetings required by their partner program (annual evaluation meetings, qualifying exams, proposal defense, etc.). The nature and timing of these formal meetings vary according to each partner discipline's graduate requirements and program practices.

Minor

Requirements listed here are in addition to requirements for minors in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

An interdisciplinary graduate minor in Women's, Gender, and Sexuality Studies is available. A student seeking a minor does not have to pass through an admissions process, and a minor can be completed by any student who is simultaneously completing any graduate degree at Penn State.

Master's Minor

Master's Minor Requirements: To earn a master's-level graduate minor students are required to take 9 credits of course work in Women's, Gender, and Sexuality Studies. Six of these credits include WMNST 502 Global Feminisms (3 cr.) and WMNST 507 Feminist Theory (3 cr.). The additional three credits must be chosen in consultation with and pre-approval from the Director of Graduate Studies in WGSS.

Doctoral Minor

To earn a doctoral-level minor in Women's, Gender, and Sexuality Studies students are required to complete 15 credits of graduate course work. Nine of these credits must include core theory: WMNST 502 Global Feminisms (3 cr.), WMNST 507 Feminist Theory (3 cr.), and either WMNST 509 Feminist Pedagogies (3 cr.) or WMNST 508 Feminist Methodologies (3 cr.). Students also must complete 6 additional credits of Women's Studies course work (at least 3 of which must be at the 500 level); these courses must be approved by the Director of Graduate Studies of WGSS.

Official requests to add the minor to a doctoral student's academic record must be submitted to Graduate Enrollment Services prior to establishment of the doctoral committee and prior to scheduling the comprehensive examination. The request entails completing the "add graduate minor" (<https://gradschool.psu.edu/forms-and-documents/ges-owned-forms-and-documents/addgrminorpdf/>) form, and getting the signature of the WGSS Director of Graduate Studies. At least one Graduate Faculty member from WGSS must serve on the candidate's Ph.D. committee.

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Dual-title students in Women's, Gender, and Sexuality Studies receive most of their funding through their partner discipline. The Women's, Gender, and Sexuality Studies Department offers a limited number of one-year graduate assistantships offering those students the opportunity to teach within WGSS. Dual-title students can apply in January/February (deadline: February 15) for an assistantship beginning the following academic year. These assistantships provide funding and critical professional experience for students training for positions in the field of Women's, Gender, and Sexuality Studies.

The Department of Women's, Gender, and Sexuality Studies provides several awards to dual-title students to support their research efforts and recognize their accomplishments in teaching and research. These include: the Sara Woods Outstanding Graduate Student Award, the Sara Woods Outstanding Student Teaching Award, and the Laura Richardson Whitaker Memorial Graduate Award. The department also allocates several awards from the Judith Harde Fund, which supports graduate research and professional development for students whose research is centered on reproductive justice.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Women's Studies (WMNST) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/wmnst/>)

Learning Outcomes

Upon completion of the dual-title graduate degree in WGSS, students are expected to:

1. Demonstrate deep conceptual and historical understanding of intersectional feminist theory and methods;
2. Apply current feminist literature from their partner discipline to their own research agenda;
3. Comprehend the conceptual and practical dimensions of feminist pedagogy, for those planning an academic career;
4. Formulate and execute an independent research project that significantly furthers knowledge and theory within interdisciplinary feminist scholarship;
5. Communicate effectively conceptual and methodological arguments in both written and oral formats to interdisciplinary audiences;
6. Exhibit a commitment to professional standards and ethics in teaching, research, and service.

Contact

Campus	University Park
Graduate Program Head	Alicia Catharine Decker
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Maha Marouan
Program Contact	Ashley Marie Scott 345C Willard Building University Park PA 16802 ams87@psu.edu (814) 865-2484
Program Website	View (http://womenstudies.psu.edu/)

Workforce Education and Development

Graduate Program Head	Susan Land
Program Code	WFED
Campus(es)	University Park (Ph.D., M.S., M.Ed.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Master of Education (M.Ed.) Dual-Title Ph.D., M.S., and M.Ed. in Workforce Education and Development and Comparative and International Education Dual-Title Ph.D. and M.S. in Workforce Education and Development and Operations Research
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=WFED)

The general focus of the program is preparation for entry into professional positions within the broadly conceived field of workforce education and development, including human resource development in industry, secondary and postsecondary technical education, and employability programs for special populations. Emphases within the program include: training and development/human resources, leadership/administration, school-to-work, and postsecondary technical and community college leadership.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Admission to graduate degree programs in Workforce Education and Development (WFED) is based on the faculty's evaluation of an applicant's prior undergraduate and graduate work, relevant prior work experience including military service, and career goals. A minimum undergraduate GPA of 2.50 is required for admission to the master's degree program.

A GPA of 3.00 in prior graduate course work is required for admission to the doctoral program. Two or more years of prior full-time work

experience that is relevant to WFED is an important consideration in evaluating applications for the doctoral program.

Degree Requirements

Master of Education (M.Ed.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

An M.Ed. degree is offered in Workforce Education and Development, which requires a minimum of 30 credits beyond the baccalaureate degree. Students in the M.Ed. degree program must complete a written comprehensive examination.

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

An M.S. degree is offered in Workforce Education and Development, which requires a minimum of 30 credits beyond the baccalaureate degree. M.S. students must complete a master's thesis or paper.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The Ph.D. degree is offered in Workforce Education and Development. Students are not formally granted candidate status for a doctoral degree until successfully completing the comprehensive examination.

Dual-Titles

Dual-Title M.Ed., M.S., and Ph.D. in Workforce Education and Development and Comparative and International Education

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Students must apply and be admitted to the graduate program in Workforce Education and Development and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Comparative and International Education dual-title program. Refer to the Admission Requirements section of the Comparative and International Education Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/comparative-international-education/>). Doctoral students must be admitted into the dual-title degree program in Comparative and International Education prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Workforce Education and Development. In addition, students must complete the degree requirements for the dual-title in Comparative and International Education, listed on the Comparative and International Education Bulletin

page (<http://bulletins.psu.edu/graduate/programs/majors/comparative-international-education/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Workforce Education and Development and must include at least one Graduate Faculty member from the Comparative and International Education program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Workforce Education and Development and Comparative and International Education. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Workforce Education and Development and Comparative and International Education dual-title Ph.D. student must include at least one member of the Comparative and International Education Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Comparative and International Education, the member of the committee representing Comparative and International Education must be appointed as co-chair. The Comparative and International Education representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Workforce Education and Development and Comparative and International Education. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Title M.S. and Ph.D. in Workforce Education and Development and Operations Research

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admission Requirements

Students must apply and be admitted to the graduate program in Workforce Education and Development and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Operations Research dual-title program. Refer to the Admission Requirements section of the Operations Research Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>). Doctoral students must be admitted into the dual-title degree program in Operations Research prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Workforce Education and Development. In addition, students must complete the degree

requirements for the dual-title in Operations Research, listed on the Operations Research Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Workforce Education and Development and must include at least one Graduate Faculty member from the Operations Research program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Workforce Education and Development and Operations Research. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of a Workforce Education and Development and Operations Research dual-title Ph.D. student must include at least one member of the Operations Research Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Operations Research, the member of the committee representing Operations Research must be appointed as co-chair. The Operations Research representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Workforce Education and Development and Operations Research. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Workforce Education and Development (WFED) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/wfed/>)

Learning Outcomes

Master of Education (M.Ed.) and Master of Science (M.S.)

1. **KNOW.** Graduates will be able to demonstrate deep conceptual understanding and proficiency in Workforce Education and Development theory and applied education at the level required to contribute to the discipline (such as Career and Technical Education or Training and Development/Organization Development).
2. **CRITICAL THINKING.** Graduates will be able to critically conceptualize and define the educational aspects of a problem as part of research in Workforce Education and Development.
3. **RESEARCH.** Graduates will demonstrate proficiency in designing and executing a research strategy to answer significant questions having real-world applications in the field of Workforce Education and Development (which includes Career and Technical Education and Training and Development/Organization Development).
4. **COMMUNICATE.** Graduates will be able to effectively communicate an instructional argument or findings in formal presentations and in written works to scholars in the field and to policy audiences.
5. **PROFESSIONAL PRACTICE.** Graduates will demonstrate a commitment to active citizenship in the discipline, including engagement in professional service to the profession and society at large.

Doctor of Philosophy (Ph.D.)

1. **Know/Think:** Graduates will demonstrate in-depth knowledge of the core theories and research methods in the field of Workforce Education and Development (WFED). The core demonstration will include the interpretation of theories of workforce education and development to conceptualize problems of educational practice.
2. **Apply/Create/Think:** Graduates will be able to formulate and execute an independent research project that significantly furthers knowledge and theories in WFED.
3. **Apply/Create:** Graduates will demonstrate the ability to apply theories to inform/develop unique designs and solutions to educational problems.

4. **Communicate/Think:** Graduates will be able to convey ideas or arguments in clear, concise, well-organized papers and proposals as well as in formal, oral presentations.
5. **Professional practice:** Graduates will demonstrate knowledge of the professional standards and ethics in the field through written and oral products, and interactions with colleagues.

Professional Licensure/Certification

Many U.S. states and territories require professional licensure/certification to be employed. If you plan to pursue employment in a licensed profession after completing this program, please visit the Professional Licensure/Certification Disclosures by State (<https://www.psu.edu/state-licensure-disclosures/>) interactive map.

Contact

Campus	University Park
Graduate Program Head	Susan Land
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Heather Toomey Zimmerman
Program Contact	Susan Berzonsky 301 Keller University Park PA 16802 sfb11@psu.edu (814) 863-0095
Program Website	View (https://ed.psu.edu/academics/departments/department-learning-and-performance-systems/workforce-education-and-development/)

Graduate Minors

A graduate minor may be taken in any of the approved graduate major degree programs. In addition, there are stand-alone graduate minors which are unaffiliated with a graduate major and approved by Graduate Council, listed below. Graduate minors are available for both master's and doctoral degrees; see the following Graduate Minors policies for more details: Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>), Minor - Professional Doctoral Degrees (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>), Minor - Research Master's Degrees (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>), Minor - Professional Master's Degrees (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>).

- Computational Materials Graduate Minor
- Computational Science Graduate Minor
- Electrochemical Science and Engineering Graduate Minor
- Gerontology Graduate Minor
- Holocaust and Genocide Studies Graduate Minor
- Information and Communication Technologies for Development Graduate Minor
- Jewish Studies Graduate Minor
- Latin American Studies Graduate Minor
- Latina and Latino Studies Graduate Minor

- Linguistics Graduate Minor
- Literary Theory, Criticism, and Aesthetics Graduate Minor
- Science, Technology, and Society Graduate Minor
- Social Thought Graduate Minor

Computational Materials Graduate Minor

Minor Graduate Program Head	Susan Sinnott
Program Code	CMPMT
Campus(es)	University Park
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=CMPMT)

The use of computational modeling tools is ubiquitous in materials research. The Computational Materials minor provides a fundamental graduate education in materials simulation techniques. The course work:

1. provides foundational courses in materials modeling, offered at various length scales,
2. integrates both broad foundational courses for students interested in a wide range of modeling techniques and/or specialized courses allowing students to develop depth in a specific modeling technique/scale, and
3. provides a flexible set of electives that will assure students are exposed to materials-related phenomena in their area of expertise.

The minor provides students the recognition of having built a background in Computational Materials, as well as the access and oversight of faculty in the minor to help them integrate these concepts with their doctoral research.

Admission Requirements

Admission to the minor will require completion of a first core course in the minor, approval from the student's major Graduate Program Head/ Graduate Program Chair/Director of Graduate Studies or Professor-in-Charge, and submission of a minor plan of study (listing intended courses by semester and approved by the student's intended minor faculty dissertation committee member) submitted to the MATSE department graduate program coordinator. A form for the minor plan of study and its approval is available from the graduate minor program. Graduate students in good standing (with current graduate GPA at or above 3.0) who have approval and who have completed a minor core course with a grade of B or higher will be admitted to the minor.

Minor Requirements

Requirements listed here are in addition to requirements for minors in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The doctoral minor consists of no fewer than 15 credits, 9 credits of which must be from a list of core minor courses, and 6 credits of which are elective courses. A minimum of 6 credits must be at the 500 level.

Code	Title	Credits
Core Minor Courses		
Select 9 credits from the following:		9
CHEM 565	Quantum Chemistry I	
CHEM 566	Quantum Chemistry II	
PHYS 561	Quantum Mechanics I	
PHYS 512	Quantum Theory of Solids I	
MATSE 419	Computational Materials Science and Engineering	
MATSE 544	Computational Materials Science of Soft Materials	
MATSE 580	Computational Thermodynamics	
MATSE 581	Computational Materials Science II: Continuum, Mesoscale Simulations	
Electives		
Select 6 credits from list of electives		6
Total Credits		15

A list of elective courses is maintained by the Department of Materials Science and Engineering. The Department also maintains a list of faculty who may represent the minor on dissertation committees. The minor is only available to doctoral students. Official requests to add a minor to a doctoral student's academic record must be submitted to Graduate Enrollment Services prior to establishment of the dissertation committee and prior to scheduling the comprehensive examination. At least one Graduate Faculty member from the minor field must serve on the candidate's dissertation committee.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Contact

Campus	University Park
Graduate Program Head	Susan B Sinnott
Program Contact	Sue Hyde 221 Steidle Building University Park PA 16802 esh17@psu.edu (814) 865-9857
Program Website	View (https://www.matse.psu.edu/degree-programs/graduate/computational-materials-doctoral-minor/)

Computational Science Graduate Minor

Minor Graduate Program Head	Daning Huang
Program Code	CSCI
Campus(es)	University Park
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=CSCI)

The Department of Aerospace Engineering administers this interdisciplinary minor. Each student's program is planned by the student and a designated computational science adviser, in consultation with the graduate adviser in the student's major field.

Minor Requirements

Requirements listed here are in addition to requirements for minors in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The minor offers an opportunity for students in all colleges and majors to pursue a focused set of courses that emphasize computational science. The minor requires 9 credits in computational science courses for a master's degree and 15 credits for a doctoral minor.

Code	Title	Credits
Required Courses		
Select at least one of the following courses:		3
AERSP 424	Advanced Computer Programming	
CMPSC 450	Concurrent Scientific Programming	
NUCE 530	Parallel/Vector Algorithms for Scientific Applications	
CSE 557	Concurrent Matrix Computation	
Select at least one of the following courses:		3
MATH 523	Numerical Analysis I	
MATH/CSE 550	Numerical Linear Algebra	
STAT 500	Applied Statistics	
STAT/IST 557	Data Mining I	
Select additional credits from a list of approved courses ¹		3-9
Total Credits		9-15

¹ The additional credits will be chosen from a list of approved courses maintained by the graduate minor program.

In addition, for the Master's Minor and Ph.D. Minor the students can use at most 6 and 9 credits, respectively, from (or cross-listed with) their home department.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up

deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Contact

Campus	University Park
Graduate Program Head	Daning Huang
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Daning Huang
Program Contact	Lindsay Moist 233 Hammond Building University Park PA 16802 lnm3@psu.edu (814) 865-6997
Program Website	View (https://sites.psu.edu/csci/)

Electrochemical Science and Engineering Graduate Minor

Minor Graduate Program Head	Mort Webster
Program Code	ECSE
Campus(es)	University Park
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=ECSE)

This graduate minor is highly relevant to numerous graduate degree programs associated with energy, materials, and environmental sciences offering a unique set of skills that will benefit graduate students to develop expertise in electrochemical systems that complements their primary focus in batteries, fuel cells, or structural design. The minor will also help expand the students' knowledge and capabilities in important topics relating to electrochemical and renewable energy fundamentals, devices and systems.

Admission Requirements

Any graduate student enrolled at Penn State in a related field of study may be admitted to the Electrochemical Science and Engineering graduate minor.

Minor Requirements

Requirements listed here are in addition to requirements for minors in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The doctoral minor will consist of no fewer than five 3-credit courses (15 credits) of integrated or articulated work in electrochemical science and engineering, related to but different from, that of the major, drawn from the two lists (500-level courses and 400-level courses) below, with a preponderance of courses at the 500 level. A minimum of 6 credits must be at the 500 level for the doctoral minor.

Code	Title	Credits
500-level Courses		
EME 541	Electrochemical Science and Engineering Fundamentals	3
CHEM 524	Electroanalytical Chemistry	3

ESC 501	Solar Cell Devices	3
CHE/MATSE 510	Surface Characterization of Materials	3
CHE 528	Colloidal Forces and Thermodynamics	3
MATSE 560/ MNPR 507	Hydrometallurgical Processing	3
MATSE 501	Thermodynamics of Materials	3
MATSE 503	Kinetics of Materials Processes	3
400-level Courses		
EGEE 420	Hydrogen and Fuel Cells	3
EGEE 437	Design of Solar Energy Conversion Systems	3
EGEE 441	Electrochemical Engineering Fundamentals	3
EME 407	Electrochemical Energy Storage	3
ESC 455	Electrochemical Methods Engineering and Corrosion Science	3
MATSE 421	Corrosion Engineering	3
ME 403	Polymer Electrolyte Fuel Cell Engines	3

The master's minor will consist of no fewer than two 3-credit courses (6 credits) of integrated or articulated work in electrochemical science and engineering, related to but different from, that of the major, drawn from the two lists above. A minimum of 3 credits must be at the 500 level for the master's minor.

A student enrolled in this graduate minor must receive a grade of B- or better in all minor courses.

A representative from the Graduate Faculty in the graduate minor (i.e., a "Minor Field Member") must be appointed to the dissertation committee of each student enrolled in the doctoral minor in Electrochemical Science and Engineering.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Contact

Campus	University Park
Graduate Program Head	Jeremy Michael Gernand
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Serguei Lvov
Program Contact	Serguei Lvov 207 Hosler Building University Park PA 16802 sx129@psu.edu (814) 863-8377
Program Website	View (http://www.eme.psu.edu/emegrad/)

Gerontology Graduate Minor

Program Code	GERON
Campus(es)	University Park
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=GERON)

The interdisciplinary graduate minor in Gerontology is administered by a committee of faculty appointed by the Gerontology Center Advisory Board. The committee members represent diverse programs within the University.

Minor Requirements

Requirements listed here are in addition to requirements for minors in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Students admitted to the minor will develop a course of study that includes both prescribed course work and additional course work suited to the student's interests. The minor course of study will be developed jointly by the student, the student's academic adviser, and one member of the graduate minor gerontology committee. Contact the Gerontology Center (S-105 Henderson) for information regarding the committee membership.

The minor requires a minimum of 10 credits of the master's level and 15 credits at the doctoral level, 10 of which are prescribed.

Code	Title	Credits
Required Courses		
BIOL 409	Biology of Aging	3
HDFS/PSYCH 445	Development Throughout Adulthood	3
HDFS 590	Colloquium	1
SOC 435/ HDFS 434	Perspectives on Aging	3
Total Credits		10

Doctoral students must select a minimum of 5 additional credits from among the following courses:

Code	Title	Credits
ADTED 460	Introduction to Lifelong Learning and Adult Education	3
ADTED 505	The Teaching of Adults	3
EDPSY 527		3
HDFS 446		3
HDFS 447	Issues in Gerontology	3
HDFS 579	Seminar in Adult Development and Aging	1-9
HPA 442	Long-Term Care Management	3
NURS 464	Dying and Death	3

Gerontology-related special topics courses (497, 597) or independent studies (496, 596)

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Contact

Campus	University Park
Graduate Program Head	Judith E Hupcey
Program Contact	118 Henderson Building University Park PA 16802

Holocaust and Genocide Studies Graduate Minor

Minor Graduate Program Head	Eliyana Adler
Program Code	HGS
Campus(es)	University Park

Holocaust and Genocide Studies (HGS) graduate minor is an interdisciplinary program of study administered by the Jewish Studies program and including courses from Jewish Studies as well as German and Slavic Languages and Literatures, English, French, Political Science, and History. Students from across the university will be exposed to courses relating to Holocaust and Genocide Studies. In order to explore or declare the minor, students will meet with the Director of Graduate Studies and develop courses of study suited to their individual interests.

Minor Requirements

Requirements listed here are in addition to requirements for minors in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The Holocaust and Genocide Studies graduate minor is available as a doctoral minor and a master's minor. The doctoral minor will require the completion of a minimum of 15 credits in a field related to, but different from, that of the student's graduate major program. A minimum of 6 credits must be at the 500 level for the doctoral minor. Students are required to take either JST/GER 524 or 536 in order to complete the minor. If these courses have not been offered with sufficient frequency during their time taking courses, they can petition to replace this requirement with a related course. Official requests to add the minor to a doctoral student's academic record must be submitted to Graduate Enrollment Services prior to establishment of the Ph.D. committee and prior to scheduling the comprehensive examination. At least one Graduate Faculty member from the minor field must serve on the candidate's Ph.D. committee.

The master's minor requires a minimum of 9 credits in a field related to, but different from, that of the student's graduate major program. For students in a research master's degree, a minimum of 3 credits must be at the 500 level for the master's minor. For students in a professional master's degree, at least 50% of credits must be at the 500 or 800 level.

courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

contact

Campus	University Park
Graduate Program Head	Eliyana Adler
Program Contact	Eliyana Adler era12@psu.edu (814) 867-5908

Information and Communication Technologies for Development Graduate Minor

Minor Graduate Program Head	Krishna Jayakar
Program Code	ICT4D
Campus(es)	University Park
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=ICT4D)

The inter-college graduate minor in ICT4D provides doctoral and master's students with exposure to the multidisciplinary theoretical and methodological foundations of ICT4D and opportunities for scholarly engagement with communities of practice in the discipline. It will challenge students to simultaneously develop new concepts, theories, and methods for the study of ICT4D, and to apply this knowledge to socially relevant projects and programs.

The ICT4D Consortium will provide organizational support for the proposed graduate minor. The Consortium currently includes faculty from the Colleges of Agriculture, Business, Communication, and Information Sciences and Technology. Courses for the minor are drawn from these colleges, the College of Engineering and the School of International Affairs.

Admission Requirements

Students in any doctoral and master's degree program at Penn State may enroll in the doctoral or master's minor respectively with the consent of the student's major adviser, the faculty coordinator of the ICT4D Consortium, and the Graduate School.

Minor Requirements

Requirements listed here are in addition to requirements for minors in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The doctoral minor will require the completion of a minimum of 15 credits of integrated or articulated course work in information and communication technologies for development, related to but different

from that of the student's major, chosen from the list maintained by the Bellisario College of Communications, with a preponderance of courses at the 500 level. A minimum of 6 credits must be at the 500 level for the doctoral minor. At least 3 credits must be from information and communications technologies and at least 3 from development, as identified in the list of courses maintained by the Bellisario College of Communications. Official requests to add the minor to a doctoral candidate's academic record must be submitted to Graduate Enrollment Services prior to establishment of the dissertation committee and prior to scheduling the comprehensive examination. At least one Graduate Faculty member from the minor field must serve on the candidate's dissertation committee.

The master's minor requires a minimum of 6 credits of integrated or articulated course work in information and communication technologies for development, related to but different from, that of the student's major, chosen from the list maintained by the Bellisario College of Communications, with a preponderance of courses at the 500 level. A minimum of 3 credits must be at the 500 level for the master's minor. At least 3 credits must be from information and communications technologies and at least 3 from development, as identified in the list of courses maintained by the Bellisario College of Communications.

A list of courses approved to count towards this minor is maintained by the Bellisario College of Communications. Note: A competitive enrollment process might be instituted for any course or sequence of courses for which there is significant enrollment demand from the ICT4D minor, beyond the capacity of the offering College/School to fulfill.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Contact

Campus	University Park
Graduate Program Head	Krishna Prasad Jayakar
Program Contact	Krishna Prasad Jayakar kpj1@psu.edu (814) 863-1243

Jewish Studies Graduate Minor

Minor Graduate Program Head	Eliyana Adler
Program Code	JST
Campus(es)	University Park

The Jewish Studies graduate minor is an interdisciplinary program of study administered by the Jewish Studies Program and including courses from Jewish Studies as well as German and Slavic Languages and Literatures, English, Classics and Ancient and Mediterranean Studies and History. Students from across the university will be exposed to courses relating to Jewish culture in a variety of eras and parts of the world. In order to explore or declare the minor, students will meet with the

Director of Graduate Studies and develop courses of study suited to their individual interests.

Minor Requirements

Requirements listed here are in addition to requirements for minors in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The Jewish Studies graduate minor is available as a doctoral minor and a master's minor. The doctoral minor will require the completion of a minimum of 15 credits in a field related to, but different from, that of the student's graduate major program. A minimum of 6 credits must be at the 500 level for the doctoral minor. Official requests to add the minor to a doctoral student's academic record must be submitted to Graduate Enrollment Services prior to establishment of the Ph.D. committee and prior to scheduling the comprehensive examination. At least one Graduate Faculty member from the minor field must serve on the candidate's Ph.D. committee. The master's minor requires a minimum of 9 credits in a field related to, but different from, that of the student's graduate major program. For students in a research master's degree, a minimum of 3 credits must be at the 500 level for the master's minor. For students in a professional master's degree, at least 50% of credits must be at the 500 or 800 level.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Contact

Campus	University Park
Graduate Program Head	Eliyana Adler
Program Contact	Eliyana Adler era12@psu.edu (814) 867-5908

Latin American Studies Graduate Minor

Minor Graduate Program Head	Matthew Restall
Program Code	LATAM
Campus(es)	University Park
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=LATAM)

The Latin American Studies graduate minor is administered by the Latin American Studies committee. The minor offers students the ability to study the region of Latin America from an interdisciplinary perspective and is open to students from across the University. It is housed in three departments: History; Comparative Literature; and Spanish, Italian and Portuguese. Graduate students from across the University are

encouraged to participate. Students who are admitted to the minor will develop courses of study suited to their special interests.

Minor Requirements

Requirements listed here are in addition to requirements for minors in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The minor for each student will be planned jointly by the student, the student's doctoral adviser, and an adviser designated by the Latin American Studies committee. Any change in the plan must be approved by both advisers. A minimum of 15 credits must be completed, with a minimum of 6 credits at the 500-level. Per Graduate Council regulations for the minor, a representative of the minor will participate on the student's dissertation committee.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Contact

Campus	University Park
Graduate Program Head	Matthew Bennett Restall
Program Contact	Matthew Bennett Restall 108 Weaver Building University Park PA 16870 mxr40@psu.edu
Program Website	View (https://www.latinamericanstudies.la.psu.edu/)

Latina and Latino Studies Graduate Minor

Minor Graduate Program Head	A. K. Sandoval-Strausz
Program Code	LTNST
Campus(es)	University Park
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=LTNST)

The Latina and Latino Studies graduate minor is an interdisciplinary minor that will be administered by a faculty committee appointed by the dean of Liberal Arts and made up of faculty in English, Comparative Literature, Spanish, and other appropriate disciplines. Graduate students from across the university are encouraged to participate. Students who are admitted to the minor will develop courses of study suited to their special interests.

Minor Requirements

Requirements listed here are in addition to requirements for minors in Graduate Council policies listed under GCAC-600 Research Degree

Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The minor for each student will be planned jointly by the student, the student's doctoral adviser, and an adviser designated by the Latina and Latino Studies committee. Any change in the plan must be approved by both advisers. A minimum of 15 credits must be completed. Per Graduate Council regulations for the minor, a representative of the minor will participate on the student's dissertation committee. This representative may be a member of the Latina and Latino Studies committee or any other faculty member approved by that committee.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Contact

Campus	University Park
Graduate Program Head	A K Sandoval-Strausz
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	A K Sandoval-Strausz
Program Contact	A K Sandoval-Strausz 302 Walker Building University Park PA 16802 aus1050@psu.edu
Program Website	View (http://www.latino.psu.edu/)

Linguistics Graduate Minor

Minor Graduate Program Head	Janet Van Hell
Program Code	LING
Campus(es)	University Park
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=LING)

The graduate minor provides interested students with an opportunity to complete a program of scientific study focused on the nature, structure, and use of human language. The minor is designed to cover the foundations of the discipline of linguistics by reviewing fundamental core areas such as phonology and syntax. Course work is also available in many additional areas of linguistics such as semantics, morphology, language variation, historical linguistics, and discourse analysis.

Minor Requirements

Requirements listed here are in addition to requirements for minors in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The minor requires a minimum of 15 credits, 6 of which must be at the 500 level. Nine credits are prescribed in syntax (LING 402), phonology (LING 404), and a general introduction to linguistics (LING 401), although

a linguistics course at the 500 level may be substituted for LING 401 with the approval of the director of the program in Linguistics.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Contact

Campus	University Park
Graduate Program Head	Janet van Hell
Program Contact	110 Moore University Park PA 16802
Program Website	View (http://linguistics.la.psu.edu/)

Literary Theory, Criticism, and Aesthetics Graduate Minor

Minor Graduate Program Head	Thomas Beebee
Program Code	LITTH
Campus(es)	University Park
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=LITTH)

This is an interdisciplinary doctoral minor that is administered by two designated advisers, one from the Department of Comparative Literature and one from the Department of Philosophy. Students who are admitted to the minor will develop courses of study suited to their special interests.

Minor Requirements

Requirements listed here are in addition to requirements for minors in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The minor for each student will be planned jointly by the student and the two advisers, in consultation with the student's doctoral adviser in his or her major field. Any change in the plan must be approved by all of the advisers. A minimum of 15 credits must be selected from among the following courses (including at least 3 credits each in comparative literature and philosophy, chosen from the asterisked courses):

Code	Title	Credits
ARTH 410	Taste and Criticism in Art	3
CAS 503	Rhetorical Criticism	3
CAS 505	Historical Development of Rhetorical Theory	3
CAS 507	Issues in Rhetorical Theory	3
CMLIT 502	Comparative Criticism I: Classical to Neoclassical *	1-3
CMLIT 503	Comparative Criticism II: Romantic to Contemporary *	1-3
CMLIT 580	Contemporary Literary Theory	3

ENGL 582	Survey of Contemporary Literary Theory	3
ENGL 583	Studies in Critical Theory	1-3
FR 571	French Literary Theory and Criticism	3
GER 591	German Literary Theory and Criticism	3-6
PHIL 413	Seminar in Philosophy of Literature	3
PHIL 502	European Philosophy Seminar	3
PHIL 516	Aesthetic Seminar *	3
SPAN 587	Stylistic and Literary Criticism	3

3 credits of SUBJ 596 in one of the nine subject areas indicated may be substituted for one of the non-asterisked 3-credit courses.

A student majoring in one of the nine subject areas may not include any courses in that field as part of the minor. Appropriate courses may be substituted.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Contact

Campus	University Park
Graduate Program Head	Thomas Oliver Beebee
Program Contact	Thomas Oliver Beebee 311 Burrowes University Park PA 16802 tob@psu.edu
Program Website	View (http://www.personal.psu.edu/faculty/t/o/tob/minor/)

Science, Technology, and Society Graduate Minor

Program Code	STS
Campus(es)	University Park

This interdisciplinary graduate minor is administered by the Science, Technology, and Society Program. Each student's program will be planned by the student and designated STS graduate adviser, in consultation with the graduate adviser in the student's major field.

The goal of the graduate minor in Science, Technology, and Society is to complement graduate and professional students' major programs through study of the interactions among science, technology, and society. More specific objectives are to promote scholarship in the humanities and social sciences concerning the social and ethical dimensions of science and technology; to inform those training in the scientific and technical professions about the social and ethical dimensions of their professional practice; and to develop research and rhetorical skills used in shaping public discourses about, and public policies regulating, science and technology.

Minor Requirements

Requirements listed here are in addition to requirements for minors in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The minor requires 9 credits in STS courses for a master's and 15 credits for a doctoral minor.

Code	Title	Credits
STS 589	Ethics and Values in Science and Technology	3
STS 591		3
The remaining credits may include 400- and 500-level courses, including Special Topics and Individual Studies.		3-9
Total Credits		9-15

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Social Thought Graduate Minor

Minor Graduate Program Head	Alan Sica
Program Code	SOCTH
Campus(es)	University Park
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=SOCTH)

The purpose of the Social Thought minor is to enable graduate students in a variety of fields to study theories of society across conventional disciplinary boundaries. The minor enables qualified students to enrich their own chosen fields of study with readings and discoveries from other, contiguous fields.

Minor Requirements

Requirements listed here are in addition to requirements for minors in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

The minor requires at least 15 credits of courses with social thought content. These are courses taught by STP Affiliated Faculty or those approved by the STP Advisory Committee. Those 15 credits must include the following: at least 9 credits of courses from outside the student's major discipline and SOCTH 501. In addition, at least one member of the student's dissertation committee must be an STP Affiliated Faculty and preferably be from outside the student's major discipline.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may

be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Contact

Campus	University Park
Graduate Program Head	Alan M Sica
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Alan M Sica
Program Contact	Eunice M Hockenberry 213 Oswald Tower University Park PA 16802 emf133@psu.edu
Program Website	View (https://stp.la.psu.edu/graduate-minor/)

Graduate Certificates

Postbaccalaureate and Graduate Credit Certificate Programs

A graduate or postbaccalaureate credit certificate program is a group of courses that focuses upon an area of specialized knowledge or information and is developed, supervised, and evaluated by the faculty members of the academic unit offering the program. Postbaccalaureate credit certificate programs reflect emerging academic areas, and may supplement or enhance existing degree programs. Postbaccalaureate certificates and graduate certificates differ in the number of graduate credits required; see the Postbaccalaureate Credit Certificate Programs policy (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>) for more details.

- Accounting Foundations Graduate Credit Certificate Program
- Accounting Graduate Credit Certificate Program
- Additive Manufacturing and Design Graduate Credit Certificate Program
- Adult Basic Education Post-baccalaureate Credit Certificate Program
- Adult Education in the Health and Medical Professions Graduate Credit Certificate Program
- Adult Gerontology Acute Care Nurse Practitioner Graduate Credit Certificate Program
- Adult Gerontology Primary Care Nurse Practitioner Graduate Credit Certificate Program
- Advanced Principal Graduate Credit Certificate Program
- Agricultural Biosecurity and Food Defense Graduate Credit Certificate Program
- AI Engineering Graduate Credit Certificate Program
- Analytics for Managers Graduate Credit Certificate Program
- Ancient Languages Postbaccalaureate Credit Certificate Program
- Applied Behavior Analysis Graduate Credit Certificate Program
- Applied Demography Graduate Credit Certificate Program
- Applied Statistics Graduate Credit Certificate Program
- Business Analytics Graduate Credit Certificate Program
- Business Architecture Graduate Credit Certificate Program

- Business Management Foundations Graduate Credit Certificate Program
- Business Process Integration Graduate Credit Certificate Program
- Business Sustainability Strategy Graduate Credit Certificate Program
- Business-to-Business Marketing Graduate Credit Certificate Program
- Children's Literature Graduate Credit Certificate Program
- Clinical Research Graduate Credit Certificate Program
- Community and Economic Development Graduate Credit Certificate Program
- Computer Vision Graduate Credit Certificate Program
- Corporate Innovation and Entrepreneurship Graduate Credit Certificate Program
- Counterterrorism Graduate Credit Certificate Program
- Cyber Threat Analytics and Prevention Graduate Credit Certificate Program
- Data Analytics and Engineering Graduate Credit Certificate Program
- Data Analytics Graduate Credit Certificate Program
- Data Engineering for Analytics Graduate Credit Certificate Program
- Dietetic Internship Postbaccalaureate Credit Certificate Program
- Distance Education Postbaccalaureate Credit Certificate Program
- Diversity and Inclusion as Strategy Graduate Credit Certificate Program
- Diversity, Ethics, and Leadership Postbaccalaureate Credit Certificate Program
- e-Learning Design Graduate Credit Certificate Program
- Educating Individuals with Autism Postbaccalaureate Credit Certificate Program
- Educational Technology Integration Postbaccalaureate Credit Certificate Program
- Electrical Engineering Post-Baccalaureate Credit Certificate Program
- Engineering Leadership and Innovation Management Graduate Credit Certificate Program
- English as a Second Language Program Specialist Postbaccalaureate Credit Certificate Program
- Enterprise Architecture Graduate Credit Certificate Program
- Enterprise Information and Security Technology Architecture Graduate Credit Certificate Program
- Entrepreneurship & New Ventures Graduate Credit Certificate Program
- Family Literacy Postbaccalaureate Credit Certificate Program
- Family/Individual Across the Lifespan Nurse Practitioner Graduate Credit Certificate Program
- Financial Accounting Graduate Credit Certificate Program
- Financial Analysis Graduate Credit Certificate Program
- Financial Analytics Graduate Credit Certificate Program
- Financial Engineering Graduate Credit Certificate Program
- Folklore and Ethnography Graduate Credit Certificate Program
- Foundations of Artificial Intelligence Graduate Credit Certificate Program
- Foundations of Data Science Graduate Credit Certificate Program
- Fundamentals of Leadership Graduate Credit Certificate Program
- Geodesign Graduate Credit Certificate Program
- Geographic Information Systems Postbaccalaureate Credit Certificate Program
- Geospatial Intelligence Analytics Graduate Credit Certificate Program
- Geospatial Programming and Web Map Development Graduate Credit Certificate Program
- Global Health Graduate Credit Certificate Program
- Global Justice and Security Graduate Credit Certificate Program
- Global Management Graduate Credit Certificate Program
- Healthcare Supply Chain and Operations Management Graduate Credit Certificate Program
- Heritage and Museum Practice Graduate Credit Certificate Program
- Homeland Security Graduate Credit Certificate Program
- Hospital and Health System Preparedness Graduate Credit Certificate Program
- Hospitality Management Graduate Credit Certificate Program
- Human Resource Management Graduate Credit Certificate Program
- Human Resources and Employment Relations Foundations Graduate Credit Certificate Program
- Information Systems Cybersecurity Graduate Credit Certificate Program
- Institutional Research Graduate Credit Certificate Program
- International Affairs Graduate Credit Certificate Program
- International Development Policy Graduate Credit Certificate Program
- International Human Resources and Employment Relations Graduate Credit Certificate Program
- International Public Policy Graduate Credit Certificate Program
- International Security Studies Graduate Credit Certificate Program
- IT Analytics Graduate Credit Certificate Program
- Labor and Collective Bargaining Postbaccalaureate Credit Certificate Program
- Labor and Employment Law Graduate Credit Certificate Program
- Leading in Diversity, Equity & Inclusion Graduate Credit Certificate Program
- Life-Cycle System Design Graduate Credit Certificate Programs
- Management Accounting Graduate Credit Certificate Program
- Management Consulting Graduate Credit Certificate Program
- Management Essentials Graduate Credit Certificate Program
- Marketing Analytics Graduate Credit Certificate Program
- Natural Language Processing Graduate Credit Certificate Program
- Negotiation and Influence Graduate Credit Certificate Program
- Nonprofit Administration Graduate Credit Certificate Program
- Nurse Administrator Graduate Credit Certificate Program
- Nurse Educator Graduate Credit Certificate Program
- Organization Development and Change: Analytics Graduate Credit Certificate Program
- Organization Development and Change: Consulting Skills Graduate Credit Certificate Program
- Organization Development and Change: Essentials Graduate Credit Certificate Program
- Organization Development and Change: Occupational Safety and Health Graduate Credit Certificate Program
- Organization Development and Change: Operational Excellence Graduate Credit Certificate Program
- Organizational Leadership Graduate Credit Certificate Program
- People Analytics and Artificial Intelligence Graduate Credit Certificate Program

- Policy Analysis and Evaluation Graduate Credit Certificate Program
- Primary Palliative Care Graduate Credit Certificate Program
- Principalship Graduate Credit Certificate Program
- Project Management Graduate Credit Certificate Program
- Project Quality Management Graduate Credit Certificate Program
- Psychology of Ethical Leadership Graduate Credit Certificate Program
- Psychology of Leadership Foundations Graduate Certificate
- Psychology of Team Leadership Graduate Credit Certificate Program
- Public Budgeting and Financial Management Graduate Credit Certificate Program
- Public Health Graduate Credit Certificate Program
- Public Health Preparedness Graduate Credit Certificate Program
- Public Sector Human Resources Management Graduate Credit Certificate Program
- Quality Management Across Product Lifecycle Graduate Credit Certificate Program
- Quantitative Business Essentials Graduate Credit Certificate Program
- Quantitative Decision Making for Engineering Managers Graduate Credit Certificate Program
- Real Estate Law and Valuation Graduate Credit Certificate Program
- Remote Sensing and Earth Observation Graduate Credit Certificate Program
- Sensory and Consumer Science Graduate Credit Certificate Program
- Software Architecture and Design Graduate Credit Certificate Program
- Solar Energy Graduate Credit Certificate Program
- Strategic Human Resources and Workplace Ethics Graduate Credit Certificate
- Strategic Leadership Graduate Credit Certificate Program
- Superintendency Graduate Credit Certificate Program
- Supply Chain and Operations Management Graduate Credit Certificate Program
- Supply Chain Management Graduate Credit Certificate Program
- Supply Chain Risk Management Graduate Credit Certificate Program
- Survey Research Methods Graduate Credit Certificate Program
- Sustainability & Social Impact Graduate Credit Certificate Program
- Sustainability Management and Policy Graduate Credit Certificate Program
- Sustainable Development in Africa Graduate Credit Certificate Program
- System Modeling and Analysis Graduate Credit Certificate Program
- System Quality & Risk Evaluation Graduate Credit Certificate Program
- Systems Data Analytics Graduate Credit Certificate Programs
- Talent Management Graduate Credit Certificate Program
- Taxation Graduate Credit Certificate Program
- Teacher Leadership Graduate Credit Certificate Program
- Technical Management and Leadership Essentials Graduate Credit Certificate Program
- Technical Management Graduate Credit Certificate Program
- Translational Science Graduate Credit Certificate Program
- Trauma-Informed Psychotherapy Graduate Credit Certificate Program

Accounting Foundations Graduate Credit Certificate Program

Person-in-Charge	Henock Louis
Program Code	CORAC
Campus(es)	World Campus

The Graduate Certificate in Accounting Foundations is a twelve-credit program for those seeking a solid foundation in accounting. Accounting systems collect and organize data about business transactions and activities. These systems also measure performance, communicate business plans and outcomes, and support decision-making. Topics include: (1) structure and content of financial reports, tax returns, and regulatory filings, (2) use of internal controls to protect an organization's resources and the integrity of its records, (3) purposes and procedures of auditing, (4) assembly and use of accounting information to plan and coordinate operations, and to make decisions. Prior knowledge of accounting is not required. Because the program covers the core topics of a baccalaureate accounting program and is delivered at a pace and depth appropriate to graduate students, the program is intensive.

The program is not suitable for those having accounting as their baccalaureate major.

Effective Semester: Summer 2023

Expiration Semester: Summer 2028

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Exceptions to GCAC-305 (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) will be considered by the program. Exceptions may or may not be granted by the Graduate School.

- Vita or Résumé — Submit a one- to two-page listing of your professional experience and education.
- Statement of Purpose — Describe how your professional experience and goals align with the Certificate in Accounting Foundations. Please do not exceed 500 words.

GRE or GMAT test scores are NOT required.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
MBADM 811	Financial Accounting	3
ACCTG 812	TAXATION	3
ACCTG 813	Auditing	3
ACCTG 814	Managerial Accounting	3
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Communication Skills –The ability to formulate and articulate business ideas individually and collaboratively via print, presentations, and interpersonal interactions. Students will demonstrate effective oral, written and interpersonal communication skills while using technology appropriately in a professional business presentation.
2. Problem Solving/Critical Thinking –The ability to demonstrate problem solving skills using analytical techniques, and adequately address open-ended/unstructured problems with no single correct solution.
3. Data Summarization and Analysis –Select and deploy appropriate data analysis schemes to arrive at reasoned recommendations.

Contact

Campus	World Campus
Graduate Program Head	Henock Louis
Program Contact	Michelle Kristen Rockower mkk114@psu.edu (814) 865-5290
Program Website	View (https://acf.smeal.psu.edu/)

Accounting Graduate Credit Certificate Program

Person-in-Charge	Renee Flasher
Program Code	ACCT
Campus(es)	Harrisburg World Campus

This graduate certificate program supplements the body of knowledge and educational credit requirements necessary for licensure as a Certified Public Accountant (CPA) in most states.

Effective Semester: Spring 2021
Expiration Semester: Spring 2026

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate->

<https://gradschool.psu.edu/graduate->admissions/how-to-apply/). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Ordinarily, an entering student will have successfully completed a baccalaureate degree in accounting or comparable accounting coursework. If the undergraduate major was not accounting, an applicant should have completed the following minimum core of accounting course work (or equivalent):

- financial and managerial accounting principles
- intermediate financial accounting I and II
- cost accounting
- federal taxation
- auditing

With program approval, all four courses in the certificate may be applied to the online Master of Professional Accounting degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>). Certificate program students who wish to have the certificate courses applied to the master's degree program must formally be admitted to the master's degree program. Admission into the master's degree program is a separate step and is not guaranteed. Upon admittance to the master's degree program, certificate courses completed with a grade of B or better may be transferred into the program.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Course		
ACCT 504	Auditing Theory and Practice	3
Electives		
Choose 3 from the following 7 courses:		9
ACCT 510	Business Tax Planning Theory and Practice	
ACCT 532	Accounting Information and Decision Systems	
ACCT 545	Strategic Cost Management	
ACCT 550	Professional Responsibilities and Ethics in Accounting	
ACCT 561	Financial Statement Analysis II	
ACCT 572	Financial Reporting I	
PADM 523	Governmental and Nonprofit Accounting	
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by

graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **CRITICAL THINKING:** Graduates will objectively identify accounting problems, and research and apply appropriate solutions.
2. **APPLY:** Graduates will successfully apply professional standards to a variety of situations.
3. **COMMUNICATE:** Graduates will effectively communicate the results of their analysis regarding various accounting problems and questions.
4. **CONDUCT:** Graduates will be cognizant of ethical and legal considerations in business

Professional Licensure/Certification

Many U.S. states and territories require professional licensure/certification to be employed. If you plan to pursue employment in a licensed profession after completing this program, please visit the Professional Licensure/Certification Disclosures by State (<https://www.psu.edu/state-licensure-disclosures/>) interactive map.

Contact

Campus	Harrisburg
Graduate Program Head	Renee Flasher
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Renee Flasher
Program Contact	Sheri Dorazio Harkins Graduate Admissions 777 W Harrisburg Pike Harrisburg PA 17057 sxh749@psu.edu (717) 948-6008
Program Website	View (https://harrisburg.psu.edu/business-administration/accounting/graduate-certificate-accounting/)
Campus	World Campus
Graduate Program Head	Renee Flasher
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Renee Flasher
Program Contact	Sheri Dorazio Harkins Graduate Admissions 777 W Harrisburg Pike Harrisburg PA 17057 sxh749@psu.edu (717) 948-6008
Program Website	View (https://harrisburg.psu.edu/business-administration/accounting/graduate-certificate-accounting/)

Additive Manufacturing and Design Graduate Credit Certificate Program

Person-in-Charge	Allison Beese
Program Code	AMD
Campus(es)	World Campus

The overall goal of the graduate AMD Certificate is to educate post-baccalaureate students and working engineers in the fundamental principles and applications of additive manufacturing. The AMD Certificate provides an entry for industry practitioners and existing workforce to gain knowledge and skills for additive manufacturing. Many workers may already have a graduate-level degree yet seek opportunities for professional development and education, particularly in additive manufacturing and design. The 12-credit curriculum will expose students to the knowledge and skills necessary to work effectively across AMD domains.

Effective Semester: Spring 2023

Expiration Semester: Spring 2028

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

The admission requirements for the students enrolling in the online AMD Certificate will be based on a combination of academic records, resume and applicable work experience, personal statement of interests, and three letters of recommendation from a previous professor or supervisor who can attest to the applicant's academic potential. Applicants will be expected to have a Bachelor of Science or four-year Associate's degree from an accredited institution in engineering, engineering technology, manufacturing, materials science, or related field. An undergraduate cumulative grade point average of 3.0 or better on a 4.0 scale in the final two years of undergraduate studies is required. Official GRE scores are not required but will be considered if submitted.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
Complete three of the following four non-laboratory courses, for a total of 12 credits:		12
EDSGN 562	Design for Additive Manufacturing	
ESC 545	Engineering and Scientific Principles of Additive Manufacturing	
IE 527	Additive Manufacturing Processes	
MATSE 567	Additive Manufacturing of Metallic Materials	
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

The overall goal of the graduate AMD Certificate is to educate post-baccalaureate students and working engineers in the fundamental principles and applications of additive manufacturing and design. Specific objectives for online students taking the AMD Certificate are to:

1. Apply foundational knowledge, critical thinking, problem solving, and creativity in the uses of additive manufacturing across industries.
2. Become competent engineers in additive manufacturing while maintaining the highest ethical standards in applying additive manufacturing to industry-relevant problems.
3. Identify the barriers to industry adoption associated with additive manufacturing technologies.
4. Articulate the value proposition for additive manufacturing in a given industry.

Contact

Campus	World Campus
Graduate Program Head	Allison Michelle Beese
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Allison Michelle Beese
Program Contact	Jaclyn Stimely Room 104, The 230 Building University Park PA 16802 juc52@psu.edu (814) 863-8069
Program Website	View (https://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-additive-manufacturing-and-design-graduate-certificate/overview/)

Adult Basic Education Post-baccalaureate Credit Certificate Program

Person-in-Charge	Esther Prins
Program Code	ABE
Campus(es)	World Campus

The goal of the program is to build educators' capacity to provide high-quality, research-based instruction in adult basic education (ABE), especially literacy and numeracy. The program is intended for people who are working, or wish to work, with adults who struggle with reading, writing, math, and/or English language proficiency. ABE instruction typically occurs in adult literacy, family literacy, GED, English as a second language (ESL), or developmental education classes offered by community-based organizations, community colleges, school districts, libraries, and alternative schools, among others. Delivered online through the World Campus, the 12-credit certificate includes three required courses and one elective, which allows students to tailor the program to their specific interests, such as ESL, program planning and administration, distance education, educational technology, adult learning, or other topics.

Effective Semester: Spring 2020

Expiration Semester: Spring 2025

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
ADTED 460	Introduction to Lifelong Learning and Adult Education	3
ADTED 560	Teaching Reading to College Students and Adults	3
ADTED 480	Teaching Math and Numeracy to Adults	3
Electives		

Select one of the following:	3
ADTED 470	Introduction to Distance Education
ADTED 505	The Teaching of Adults
ADTED 506	Program Planning in Adult Education
ADTED 507	Research and Evaluation in Adult Education
ADTED 531	Course Design and Development in Distance Education
ADTED 542	Perspectives on Adult Learning Theory
ADTED 575	Administration of Adult Education
LDT 415A	Systematic Instructional Development
Total Credits	12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

- ADULT LIT & NUMERACY:** Students will learn theories and methods of adult learning to more effectively teach adult literacy and numeracy.
- TEACHING ADULTS:** Students will learn and understand models, motivation, issues, and instructional procedures of adult and distance education.
- ADULT LEARNING:** Students will learn and understand the history, theories, and models of adult learning.
- PROGRAM PLANNING:** Students will learn about program planning, including administering and designing courses and activities in an AE program.
- EVALUATION and RESEARCH of AE PROGRAMS:** Students will learn research and evaluation models and methods in AE programs.

Contact

Campus	World Campus
Graduate Program Head	Esther Susana Prins
Program Contact	Elisabeth L. McLean 501A Walker Building University Park PA 16802 elg6@psu.edu (814) 863-3777
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-adult-basic-education-certificate/overview/)

Adult Education in the Health and Medical Professions Graduate Credit Certificate Program

Person-in-Charge	Elizabeth Tisdell
Program Code	MEDADT
Campus(es)	Harrisburg

The primary goal of the Graduate Certificate in Adult Education in the Health and Medical Professions is to assist medical/health professionals in increasing their knowledge and competence in educating adult learners in medical education/health science settings.

The objectives are to promote: awareness of how learning theory informs practice; effective methods for teaching adults; development of a reflective practice; understanding of program/instructional design.

Effective Semester: Summer 2020

Expiration Semester: Summer 2025

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Applicants must submit the following materials:

- A one-page resume
- A statement describing professional goals, experience, and responsibilities (2 pages maximum)

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
ADTED 460	Introduction to Lifelong Learning and Adult Education	3
ADTED 501	Foundations of Medical Education	3
ADTED 505	The Teaching of Adults	3

Electives

One 3-credit graduate elective related to the candidate's particular interest related to health or medical education, and could include other graduate courses in the Adult Education Program or another related area

3

Total Credits

12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

- Know:** Graduates will demonstrate in-depth understanding of foundational knowledge of medical education and adult education. A demonstration will include the analysis and application of key educational constructs across a variety of formal, nonformal and informal health and medical settings.
- Apply:** Graduates will be able to design creative curriculum, courses, and workshops and teach innovative ways for engaging adult learners in health and medical settings.
- Critical Thinking:** Graduates will develop a critically reflective practice, whereby they regularly engage in reflection about their underlying assumptions and beliefs concerning the purpose of education, the role of educator, the role of the learner, context, and diversity and equity in the education of adults
- Communicate:** Graduates will be able to convey ideas or arguments in clear, concise, well-organized written papers and oral presentations.

Contact

Campus	Harrisburg
Graduate Program Head	Elizabeth Jean Tisdell
Program Contact	Elizabeth Jean Tisdell 777 W. Harrisburg Pike Middletown PA 17057 ejt11@psu.edu (717) 948-6640
Program Website	View (http://harrisburg.psu.edu/programs/graduate-certificate-in-adult-education-in-the-health-and-medical-professions/)

Adult Gerontology Acute Care Nurse Practitioner Graduate Credit Certificate Program

Person-in-Charge	Sheri Matter
Program Code	AGACNP
Campus(es)	World Campus

The purpose of the Adult Gerontology Acute Care Nurse Practitioner certificate is to prepare individuals with a master's degree or higher in nursing seeking additional certification as an Adult Gerontology Acute Care Nurse Practitioner. The goal of this certificate is to prepare nurses to

provide direct care of adults/older adults with acute and complex illness in acute care health care settings. Applicants will have an individualized plan of study based on review of graduate transcripts.

Effective Semester: Fall 2022

Expiration Semester: Fall 2027

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Applicants are required to have a master's degree in nursing from an ACEN or CCNE accredited institution. In addition, undergraduate chemistry and statistics are required. Students need to submit two recommendations, a goal statement, and official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>). Applicants are required to have two years of experience as an RN in an acute care hospital setting.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
NURS 860	Adult Gerontology Acute Care Nurse Practitioner Role I	3
NURS 861	Adult Gerontology Acute Care Nurse Practitioner Role II	3
NURS 862D	Adult Gerontology Acute Care Nurse Practitioner Doctoral Practicum I	3
NURS 863D	Adult Gerontology Acute Care Nurse Practitioner Doctoral Practicum II	3
NURS 864D	Adult Gerontology Acute Care Nurse Practitioner Integrative Doctoral Practicum	5
NURS 865	Pharmacology for Acute Care Nurse Practitioners	1
NURS 866	Health Assessment of the Adult Gerontology Population in Acute Care	1
NURS 867	Clinical Practice Synthesis for Adult Gerontology Acute Care Nurse Practitioner	3

Additional Course Work May Be Required ¹

Advanced Practice Core

NURS 802	Advanced Health Assessment of Adult Populations
NURS 803	Pathophysiology for the Advanced Practice Nurse
NURS 804	Pharmacologic Therapy for the Advanced Practice Nurse

DNP Core

NURS 510	Theoretical and Scientific Foundations of Advanced Nursing Practice
NURS 830	Evidence-Based Practice I: Inquiry and Research Methods

Total Credits **22**

¹ Any or all of these courses may be waived based on the certificate program chair's evaluation of transcripts and prior courses completed.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Design and evaluate new models of care based on integration of theoretical and empirical knowledge from nursing and related disciplines.
2. Translate evidence to guide practice and improve outcomes of care.
3. Analyze data which predicts and explains variations in practice.
4. Provide inter-professional leadership within an increasingly complex health care delivery system.
5. Prepare leaders to use information systems and technology to support and improve patient care and health care systems.
6. Prepare leaders to direct and deliver high quality, cost-effective care for diverse populations.
7. Shape health policy and systems of health care in the local, regional, state, national, and international forums.
8. Perform independently at the most advanced level of ethical specialty nursing practice.

Professional Licensure/Certification

Many U.S. states and territories require professional licensure/certification to be employed. If you plan to pursue employment in a licensed profession after completing this program, please visit the Professional Licensure/Certification Disclosures by State (<https://www.psu.edu/state-licensure-disclosures/>) interactive map.

Contact

Campus	World Campus
Graduate Program Head	Sheri Matter
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Susan Leight
Program Contact	Cassidy Shull crh5490@psu.edu (814) 865-0368
Program Website	View (https://www.nursing.psu.edu/graduate-certificates/)

Adult Gerontology Primary Care Nurse Practitioner Graduate Credit Certificate Program

Person-in-Charge	Sheri Matter
Program Code	AGPCNP
Campus(es)	World Campus

The purpose of the Adult Gerontology Primary Care Nurse Practitioner certificate is to prepare individuals with a Master's degree or higher in nursing seeking additional certification as an Adult Gerontology Primary Care Nurse Practitioner. The curriculum includes the didactic and clinical courses required for application of the NP role and required for certification.

Effective Semester: Fall 2022
Expiration Semester: Fall 2027

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Applicants are required to have a master's degree in nursing from an ACEN or CCNE accredited institution. In addition, undergraduate chemistry and statistics are required. Students need to submit two recommendations, a goal statement, and official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>).

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
NURS 870	Nurse Practitioner Role with Healthy Individuals and Families	3
NURS 871	Nurse Practitioner Role with Individuals and Families with Complex and/or Chronic Health Problems	3
NURS 872D	Adult Gerontology Primary Care Nurse Practitioner Doctoral Practicum I	3
NURS 873D	Adult Gerontology Primary Care Nurse Practitioner Doctoral Practicum II	3
NURS 874D	Adult Gerontology Primary Care Nurse Practitioner Integrative Doctoral Practicum	5

NURS 877 Clinical Practice Synthesis for Adult Gerontology
Primary Care Nurse Practitioner 3

Additional Course Work May Be Required¹

Advanced Practice Core

NURS 802	Advanced Health Assessment of Adult Populations
NURS 803	Pathophysiology for the Advanced Practice Nurse
NURS 804	Pharmacologic Therapy for the Advanced Practice Nurse
<i>DNP Core</i>	
NURS 510	Theoretical and Scientific Foundations of Advanced Nursing Practice
NURS 830	Evidence-Based Practice I: Inquiry and Research Methods

Total Credits 20

¹ Any or all of these courses may be waived based on the certificate program chair's evaluation of transcripts and prior courses completed.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Design and evaluate new models of care based on integration of theoretical and empirical knowledge from nursing and related disciplines.
2. Translate evidence to guide practice and improve outcomes of care.
3. Analyze data which predicts and explains variations in practice.
4. Provide inter-professional leadership within an increasingly complex health care delivery system.
5. Prepare leaders to use information systems and technology to support and improve patient care and health care systems.
6. Prepare leaders to direct and deliver high quality, cost-effective care for diverse populations.
7. Shape health policy and systems of health care in the local, regional, state, national, and international forums.
8. Perform independently at the most advanced level of ethical specialty nursing practice.

Professional Licensure/Certification

Many U.S. states and territories require professional licensure/certification to be employed. If you plan to pursue employment in a licensed profession after completing this program, please visit the Professional Licensure/Certification Disclosures by State (<https://www.psu.edu/state-licensure-disclosures/>) interactive map.

Contact

Campus	World Campus
Graduate Program Head	Sheri Matter
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Susan Leight
Program Contact	Cassidy Shull crh5490@psu.edu (814) 865-0368
Program Website	View (https://www.nursing.psu.edu/graduate-certificates/)

Advanced Principal Graduate Credit Certificate Program

Person-in-Charge	Gerald LeTendre
Program Code	ADVPRN
Campus(es)	University Park

The program will build the capacity of students to achieve more equitable access and outcomes for students who become school leaders and who can be responsible for developing and sustaining a learning-centered school culture targeting excellence, equity, and efficiency. The courses will address the four major areas of competence outlined in the Pennsylvania Department of Education's Guidelines for school leaders:

- 1) contextual analysis based on a thorough understanding of qualitative and quantitative data;
- 2) skill development in team behaviors that advance action learning team effectiveness;
- 3) coaching one's peers in developing and implementing team-based action learning and learning; and
- 4) writing a case study on the effects of the team-based action learning process on achieving equitable student outcomes.

Effective Semester: Fall 2023

Expiration Semester: Fall 2028

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Master's degree in education or education-related field; Level I and Level II certificates (including but not limited to regular and special education, school psychologist, principal, school counselor, speech and language clinician, occupational and physical therapist, reading specialist, and home and school visitor); three years experience in a school leadership role.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
EDLDR 841	Data Informed Leadership	3
EDLDR 842	Coaching for Leadership Capacity and Systems Change	3
EDLDR 844	Constructing Educational Case Studies for Peer Professional Development	3
EDLDR 895	Internship (3 one-credit courses)	3
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Understand and apply multiple sources of qualitative and quantitative data to identify and act upon problems of practice within an educational setting using data informed strategies.
2. Develop leadership skills for building communities of practice toward the improvement of academic excellence, equity and, student well-being.
3. Develop and apply a set of coaching strategies to support team based action learning.
4. Document action learning through the development of case studies which reflect a contextual analysis of their school, informed by multiple sources of data and describe the ways in which system level change was conceived and implemented.

Contact

Campus	University Park
Graduate Program Head	Gerald K Letendre
Program Contact	Mark Ivicic mci104@psu.edu

Agricultural Biosecurity and Food Defense Graduate Credit Certificate Program

Person-in-Charge	Gretchen Kuldau
Program Code	AGBIO
Campus(es)	World Campus

This 12-credit graduate certificate program is designed to provide students with broad training in the field of agricultural biosecurity.

Courses cover animal and plant health, and food defense aspects of agricultural biosecurity and food defense. Content is both theoretical and applied but with an emphasis on practical application of knowledge gained. A distance education format is used to accommodate the needs of professionals already active in this area.

The certificate program is an attractive option for those who desire advanced graduate training but do not require the full Master's degree program. It is also ideal for students who wish to move into the degree program once all admissions requirements are fulfilled (e.g.,GRE); however, successful completion of a certificate program neither implies nor guarantees admission to a graduate degree program at Penn State. Certificate students who wish to have certificate courses applied towards a graduate degree must apply and be admitted to that degree program. Courses taken in the certificate program may be applied toward a graduate degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>).

Effective Semester: Fall 2023

Expiration Semester: Fall 2028

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Applicants must have a 3.0 or higher undergraduate grade-point average.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
AGBIO 520	Agricultural Biosecurity: Protecting a Key Infrastructure	3
AGBIO 521	Food Defense: Prevention Planning for Food Processors	3
AGBIO 801	Veterinary Infectious Disease Diagnostic and Surveillance Systems	3
AGBIO 802	Plant Protection: Responding to Introductions of Threatening Pests and Pathogens	3
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Graduates will be able to describe the four basic steps in agricultural biosecurity preparedness, response and recovery, and recommend actions to support each step.
2. Graduates will be able to identify main threats to plant-based agriculture and will demonstrate knowledge of the current status of national preparedness and future needs against these threats.
3. Graduates will learn, recognize, and apply measures to prevent intentional contamination of the food supply.
4. Graduates will demonstrate knowledge of diagnostic and surveillance systems used to detect infectious diseases and protect against animal agricultural biological attack.

Contact

Campus	World Campus
Graduate Program Head	Gretchen Anna Kuldau
Program Contact	210 Buckhout Lab University Park PA 16802
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/agricultural-biosecurity-certificate/overview/)

AI Engineering Graduate Credit Certificate Program

Person-in-Charge	Raghu Sangwan
Program Code	MSEAIE
Campus(es)	Great Valley World Campus

The Graduate Certificate in AI Engineering is a program for students who aim to pursue a career in AI or Machine Learning Engineering and become responsible for designing, building, and maintaining machine learning models, and models for natural language processing. Students develop knowledge and skills relevant to programming, machine learning, and natural language processing. A certificate will be awarded upon completion of the courses.

Courses taken in the certificate program may be applied toward a master's degree in Software Engineering, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards a graduate degree must apply and be admitted to that degree program. Admission to the graduate degree program is a separate step and is not guaranteed.

Effective Semester: Spring 2024

Expiration Semester: Spring 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

1. The successful applicant is generally expected to have a minimum combined junior/senior grade-point average of 3.0 (B) on a 4.0 scale.
2. Courses taken in the certificate program may be applied toward Master of Software Engineering degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards the Master of Software Engineering must apply and be admitted to that degree program. Admission to the Master of Software Engineering graduate degree program is a separate step and is not guaranteed.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
DAAN 862	Analytics Programming in Python	3
A-I 570	Deep Learning	3
A-I 574	Natural Language Processing	3
A-I 801	Foundation of Artificial Intelligence	3
Total Credits		12

All courses must be completed with a minimum grade of C or better and an overall GPA of 3.0.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Engineer AI-based solutions using machine learning, natural language understanding, search and planning, agent systems, reinforcement and deep learning techniques.
2. Analyze, architect, design, implement and test AI-based systems.

Contact

Campus	Great Valley
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Raghu Sangwan
Program Contact	MICHELLE WHALEN 30 E. Swedesford Rd. Malvern PA 19355 mmw6441@psu.edu
Campus	World Campus
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Raghu Sangwan
Program Contact	MICHELLE WHALEN 30 E. Swedesford Rd. Malvern PA 19355 mmw6441@psu.edu

Analytics for Managers Graduate Credit Certificate Program

Person-in-Charge	Zugang Liu
Program Code	ANMGR_GCT
Campus(es)	Great Valley

The Analytics for Managers Graduate Certificate provides students with the knowledge and expertise to become data-savvy managers who can effectively communicate complex business problems and data-driven decisions to the management and general business audiences. Companies are producing enormous amounts of “big data” from their everyday operations. However, there is still a lack of leaders with the proper mix of empirical and managerial savvy who can provide actionable insights from that data.

The program is designed for business professionals who want to augment their managerial expertise with a quantitative skill sets. Along with fundamental concepts in data-driven decision making, effective communication and visualization of those decisions, the program allows students to choose between general business analytics or specialize in a specific analytics area such as Accounting, Marketing, or Human Resources. Upon completion, students will be conversant in utilizing appropriate tools and techniques for presenting what happened, analyzing how and why it happened, predicting future trends, and prescribing future strategies.

Effective Semester: Fall 2023
Expiration Semester: Fall 2028

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/>)

[gcac-300/gcac-305-admission-requirements-international-students/](#)) for more information.

1. Applicants must hold either 1) a baccalaureate degree from a regionally accredited U.S. institution or (2) a tertiary (post-secondary) degree that is deemed comparable to a four-year bachelor’s degree from a regionally accredited U.S. institution. This degree must be from an officially recognized degree-granting institution in the country in which it operates. The successful applicant is generally expected to have a minimum combined junior/senior grade-point average of 3.0 (B) on a 4.0 scale.
2. Admission into the master’s program is a separate process and is not guaranteed. Certificate program students who wish to have the certificate courses applied to the master’s degree program must apply and be admitted to the master’s program. Upon admittance to the master’s program, certificate courses completed with a grade of B or better will be applied to the degree.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

To be awarded the graduate certificate, students must successfully complete 9 credits of course work with 6 required credits. All courses must be completed with a minimum grade of C or better and an overall GPA of 3.0.

Code	Title	Credits
Required Courses		
BUS 510	Business Analytics and Decision Modeling	3
Select one of the following courses:		3
ACCTG 804	Data Analytics in the Accounting Profession	
BUSAD 843	People Analytics	
IE 575	Foundations of Predictive Analytics	
DAAN 871	Data Visualization	3
MKTG 811	Driving Business Success with Marketing Analytics	
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

- Effectively communicate technical knowledge, including ideas, data analysis, findings, or decision justification in written formats in a manner appropriate to the audience.
- Identify the appropriate statistical method/tool for a given business problem/scenario and perform the subsequent analysis.

- Identify business situations in which one can apply statistical analysis and prescribe actionable insights based on the analysis.

Contact

Campus	Great Valley
Graduate Program Head	Zugang Liu
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Zugang Liu
Program Contact	DENISE Y. SMITH 30 East Swedesford Road Malvern PA 19355 dms7338@psu.edu (610) 648-3336
Program Website	View (https://greatvalley.psu.edu/academics/graduate-certificates/analytics-managers/)

Ancient Languages Postbaccalaureate Credit Certificate Program

Person-in-Charge	Daniel Falk
Program Code	ANCLNG
Campus(es)	University Park

Advanced study in classical studies, ancient history, ancient philosophy, biblical studies, Egyptology, or ancient Near Eastern studies requires demonstrable proficiency in one or more ancient languages. The certificate in Ancient Languages, comprising 12 credits, is designed to provide proficiency in at least one ancient language for students who have completed an appropriate undergraduate degree and are planning to pursue graduate work in one of these fields. Training in a second ancient language is offered, and a writing-intensive course in a subject relevant to the student's interest will strengthen preparation for graduate-level research and writing.

Effective Semester: Fall 2024
Expiration Semester: Summer 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

The applicant's baccalaureate degree must be in any humanities field that includes at least one year of study in an ancient language.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/>)

gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/).

A grade of B or better must be earned in each course to satisfy the certificate.

Code	Title	Credits
Required Courses		
Select 9 credits from the following; at least 6 credits must be in one language:		9
CAMS 420	Aramaic	
CAMS 471	Sumerian	
CAMS 472	Akkadian	
CAMS 481	Introduction to Middle Egyptian & Hieroglyphics	
CAMS 490	Ancient Mediterranean Languages	
CAMS 520	Advanced Sumerian	
CAMS 521	Advanced Akkadian	
CAMS 522	Comparative Semitics	
GREEK 420	Greek Prose Authors	
GREEK 425	Greek Historians	
GREEK 430	Greek Poetry	
GREEK 440	Greek Drama	
GREEK 496	Independent Studies	
GREEK 520	Greek Mythography	
GREEK 596	Individual Studies	
HEBR 451	Advanced Biblical Hebrew	
HEBR 452	Readings in Biblical Hebrew	
HEBR 496	Independent Studies	
LATIN 402	Republican Literature	
LATIN 403	Augustan Age Literature	
LATIN 404	Silver Age Literature	
LATIN 450W	History of Latin	
LATIN 496	Independent Studies	
LATIN 510	Latin Seminar	
LATIN 596	Individual Studies	
Select 3 credits from the following:		3
CAMS 400W	Comparative Study of the Ancient Mediterranean World	
CAMS 405	Law & Economy in the Ancient Near East (when taught as a writing intensive section)	
CAMS 410	Classical Epic (when taught as a writing intensive section)	
CAMS 411W	Classical Drama	
CAMS 440W	Studies in Classical and Ancient Mediterranean Archaeology	
CAMS 470	Languages and Cultures of the Ancient Near East (when taught as a writing intensive section)	
CAMS/JST 480	Greeks and Persians (when taught as a writing intensive section)	
CAMS 501	Comparative Greek and Latin Grammar	
CAMS 503	Seminar on Ancient Mediterranean Languages	
CAMS 550	Proseminar	
CAMS 560	Research Seminar	

CAMS 596 Individual Studies

Total Credits**12**

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Students will gain proficiency in at least one of the ancient languages offered by the department.
2. Students will gain further experience with the research methodologies of their given field.
3. Students will gain preparation for graduate work in one of the fields of CAMS.

Contact

Campus	University Park
Graduate Program Head	Daniel Keith Falk
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Mark Munn
Program Contact	Anna Irene Peterson 801 Ford Building University Park PA 16802 aip12@psu.edu (814) 865-8851

Applied Behavior Analysis Graduate Credit Certificate Program

Person-in-Charge	David Lee
Program Code	APPBA
Campus(es)	World Campus

This program is intended for those who seek advanced knowledge in the field of applied behavior analysis. The 21-credit curriculum is specifically designed to prepare students to sit for the Board Certified Behavior Analyst (BCBA) certification examination. After completing the program, students will be able to:

1. Define, apply, and explain behavior principles in response to applied situations.
2. Use evidence-based methods to collect, display, interpret, and communicate behavioral data.
3. Select, implement, and explain evidence-based methods of assessment for behavioral program implementation.
4. Select, implement, and explain evidence-based interventions to affect socially significant behavior change for clients.
5. Explain, communicate, and engage in professional practice using current ethical guidelines in behavior analysis.

Effective Semester: Spring 2020
Expiration Semester: Spring 2025

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
SPLED 505	Single-Case Research	3
SPLED 806	Foundations of Applied Behavior Analysis	3
SPLED 807	Concepts and Principles of Applied Behavior Analysis	3
SPLED 808	Assessment of Behavior in Contexts	3
SPLED 809	Behavioral Change Procedures and Management I	3
SPLED 810	Behavioral Change Procedures and Management II	3
SPLED 811	Ethical Considerations for Special Education Populations	3
Total Credits		21

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. BEH PRINCIPLES: Students will be able to define, apply, and explain behavior principles in response to applied situations.
2. BEH DATA: Students will be able to use evidence-based methods to collect, display, interpret, and communicate behavioral data.
3. BEH ASSESSMENT: Students will be able to select, implement, and explain evidence-based methods of assessment for behavioral program implementation.

4. **BEH CHANGE:**Students will be able to select, implement, and explain evidence-based interventions to affect socially significant behavior change for clients.
5. **ETHICAL PRACTICE:**Students will be able to explain, communicate, and engage in professional practice using current ethical guidelines in behavior analysis.

Professional Licensure/Certification

Many U.S. states and territories require professional licensure/certification to be employed. If you plan to pursue employment in a licensed profession after completing this program, please visit the Professional Licensure/Certification Disclosures by State (<https://www.psu.edu/state-licensure-disclosures/>) interactive map.

Contact

Campus	World Campus
Graduate Program Head	David Lee
Program Contact	David Lee 125 CEDAR Building University Park PA 16802 dxl34@psu.edu (814) 865-3567
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/applied-behavior-analysis-for-special-education-certificates/overview/)

Applied Demography Graduate Credit Certificate Program

Person-in-Charge	Eric Baumer
Program Code	APDEM
Campus(es)	World Campus

The primary goal of the program is to provide an introduction to concepts, measures, data, software, and methods used in applied demography with an emphasis on applications in the public and private sectors. Professionals who complete this 12-credit program will be able to apply demographic analysis in their careers. This certificate will allow them to support organizations and better understand and anticipate the effects of population change. This program is ideal for those interested in careers as applied demographers, data analysts, market research analysts, marketing specialists, and local, state, and regional planners.

Effective Semester: Fall 2021
Expiration Semester: Fall 2026

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/>

[gcac-300/gcac-305-admission-requirements-international-students/](https://gradschool.psu.edu/graduate-education-policies/gcac-300/gcac-305-admission-requirements-international-students/)) for more information.

Applicants must have successfully completed at least an undergraduate-level statistics course with a grade of C or better.

Applicants are expected to submit the following:

1. Completed official online Graduate School application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) and payment of a nonrefundable application fee.
2. Statement of purpose: a 2-3 pages essay articulating career and educational goals that demonstrate the student's written communication skills and basic statistical knowledge.
3. A current curriculum vitae (vita) or résumé.
4. Three letters of recommendation that attest to the student's readiness for graduate study and document the requisite minimum of two years of work experience. Letters must be submitted through the online application system. Within the online application you will be asked to enter the names and e-mail addresses of three individuals who will be providing your recommendation. Those individuals will receive a note via e-mail asking them to complete a brief form that will serve as your recommendation. Please inform all recommenders they must submit the form in order for your application to be complete.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
APDEM 801		3
APDEM 802		3
APDEM 803	Applied Demography in Practice	3
SOC 573	Demographic Techniques	3
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Students will be able apply basic technical competence in demographic methods, GIS applications to population questions, and demographic data sources and their use.

- Students will be able to apply basic working knowledge of the theoretical and methodological processes of population change and recognize how the components of population change (fertility, mortality, and migration) interrelate with each other and other social processes.
- Students will be able to recognize demographic principles and population trends that impact decision making regarding business, non-profit public sector, health and environmental issues.
- Students will be able to identify demographic data sources and problem-solving examples of applied demographic knowledge and skills.
- Students will be able to address questions and planning objectives of managers, administrators, and government officials by examining case studies of how to use demographic methods.
- Students will be able to analyze and interpret aggregate data and use it to inform public policy decisions and investments.

Contact

Campus	World Campus
Graduate Program Head	Michelle Lynn Frisco
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Stephen A. Matthews
Program Contact	Stephen A. Matthews 211 Oswald Tower University Park PA 16802 sxm27@psu.edu (814) 863-9721
Program Website	View (https://www.worldcampus.psu.edu/penn-state-online-graduate-applied-demography-programs/)

Applied Statistics Graduate Credit Certificate Program

Person-in-Charge	Prabhani Kuruppumullage Don
Program Code	STATC_GCT
Campus(es)	World Campus

The graduate certificate in Applied Statistics helps quantitative professionals in a variety of fields become knowledgeable and skillful in applied statistics. The certificate was designed specifically for researchers working with statistical data who wish to advance their careers, and for those who seek career changes.

Effective Semester: Fall 2021
Expiration Semester: Summer 2026

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/>

[gcac-300/gcac-305-admission-requirements-international-students/](https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/)) for more information.

Qualified applicants will have successfully completed one course in statistics and have knowledge of matrix and linear algebra.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Students earn the certificate by completing 12 credits of instructor-led online course work. Two 3-credit courses are required, and the remaining 6 credits are selected from a list of electives. Students who successfully complete the certificate earn 12 academic credits and receive the graduate certificate in Applied Statistics. Students subsequently admitted to the Department of Statistic's professional Master of Applied Statistics degree program may count up to 15 credits of certificate courses toward the M.A.S. degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>). Certificate students who wish to have certificate courses applied towards the Master of Applied Statistics must apply and be admitted to that degree program. Admission to the Applied Statistics graduate degree program is a separate step and is not guaranteed.

Code	Title	Credits
Required Courses		
STAT 500	Applied Statistics	3
STAT 501	Regression Methods	3
Electives		
Select at least 6 credits of the following:		6
STAT 414	Introduction to Probability Theory	
STAT 415	Introduction to Mathematical Statistics	
STAT 480	Introduction to SAS ¹	
STAT 481	Intermediate SAS for Data Management ¹	
STAT 482	Advanced Topics in SAS ¹	
STAT 483	Statistical Programming in SAS ¹	
STAT 484	The R Statistical Programming Language	
STAT 485	Intermediate R Statistical Programming Language	
STAT 487	Introduction to Statistical Analysis with Python	
STAT 502	Analysis of Variance and Design of Experiments	
STAT 503	Design of Experiments	
STAT 504	Analysis of Discrete Data	
STAT 505	Applied Multivariate Statistical Analysis	
STAT 506	Sampling Theory and Methods	
STAT 507	Epidemiologic Research Methods	
STAT 508	Applied Data Mining & Statistical Learning	
STAT 509	Design and Analysis of Clinical Trials	
STAT 510	Applied Time Series Analysis	
GEOG 483	Problem-Solving with GIS	
Total Credits		12

¹ Credits cannot be taken for both STAT 483 and STAT 480, STAT 481, or STAT 482.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **Data analytic skills:** students will be able to demonstrate their ability to apply common statistical techniques such as regression and analysis to real world problems
2. **Interpretation of Statistical results:** students will be able to communicate data analysis results orally, in writing, and visually in the context of the problem to nonstatistical audience
3. **Statistical software:** students will be able to use statistical software such as R, SAS and Minitab to conduct data analysis
4. **Data visualization:** students will be able to select and create appropriate graphs and tables to visualize data effectively.

Contact

Campus	World Campus
Graduate Program Head	Prabhani Kuruppumullage Don
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Prabhani Kuruppumullage Don
Program Contact	Amy Lyn Schmoeller 315 Thomas Building University Park PA 16802 als63@psu.edu (814) 863-7658
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/applied-statistics-certificate/overview/)

Business Analytics Graduate Credit Certificate Program

Graduate Program Head	Chris Solo
Program Code	BAN
Campus(es)	World Campus

The 9 credit graduate certificate program in Business Analytics (BAN) prepares business professionals to explore and analyze large data sets to support data-driven business decisions. The program covers the entire life cycle of a data analytics project using the descriptive/prescriptive/predictive framework for business analytics:

- descriptive (What happened?),
- predictive (What will happen?) and
- prescriptive (What should happen?)

Target audiences include business analysts, analytic systems designers and the data scientists who have a focus on problems arising in the contexts of business decision-making. The certificate program builds on basic analytic concepts that professionals are expected to have and provides a practical approach to expanding these analytic skills to perform tasks in various areas of business such as marketing, supply chains, operations, forensics, and risk.

Effective Semester: Spring 2024

Expiration Semester: Spring 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Exceptions to GCAC-305 (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) will be considered by the program. Exceptions may or may not be granted by the Graduate School.

Admissions Prerequisite Requirement

Prior knowledge of statistics – Applicants should have knowledge or experience in quantitative work such as science, engineering, or business. The objective is to establish a baseline knowledge and to prepare the student for the advanced coursework in this program. Applicants from other disciplines will be considered based on prior academic and professional experience. Qualified applicants should have successfully completed an undergraduate- or graduate-level course in statistics or be able to show significant experience using statistics in a professional capacity. If a foundation in statistics is absent, the program may require the completion of a fundamental STAT course prior to entry.

Additional Requirements

Along with the submission of the online application and the nonrefundable application fee, the following is required:

- Transcripts - Submit official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>).
- Vita or Résumé – Submit a one- to two-page listing of your professional experience.
- Statement of Intent – Describe how your professional experience and goals align with the Certificate in Business Analytics. Do not exceed 500 words.Upload to the online application.

GRE or GMAT test scores are NOT required.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/>)

gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/).

Code	Title	Credits
Required Courses		
BAN 830	Descriptive Analytics for Business	3
BAN 840	Predictive Analytics for Business	3
BAN 550	Prescriptive Analytics for Business	3
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

- Communication Skills:** Students will know how to formulate and articulate results, analysis, and strategic action plans individually and collaboratively in written, oral, or presentation form.
- Professional Skills and Problem Solving:** Using relevant tools, analytic theories, and professional observations students will be able to conduct analyses that transform data into meaningful information.
- Integrative Understanding:** Students will understand how to apply data and analytics to the full spectrum of business analytics practice (descriptive, predictive and prescriptive).

Contact

Campus	World Campus
Graduate Program Head	Chris Solo
Program Contact	Michelle Kristen Rockower 220 Business Building University Park PA 16802 mkk114@psu.edu (814) 865-5290
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/business-analytics-certificate/overview/)

Business Architecture Graduate Credit Certificate Program

Person-in-Charge	Brian Cameron
Program Code	BUSARC
Campus(es)	World Campus

The Graduate Certificate in Business Architecture is offered by the Smeal College of Business. Business Architecture (BA) is a rapidly growing field within Enterprise Architecture and IT Strategic Planning. Business architecture aligns strategic objectives and tactical initiatives that often involve the use of enterprise information technology.

This 9-credit graduate certificate will provide a holistic approach to business architecture that produces a common understanding of the

organization, its sources of innovation/distinctiveness, and an approach for effective organizational transformation and strategy execution. Course content focuses on: (1) understanding and applying the concepts of modeling approaches to an enterprise, (2) understanding and fostering sources of organizational innovation, (3) understanding effective enterprise transformation and business strategy execution.

Effective Semester: Spring 2021

Expiration Semester: Spring 2026

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Exceptions to GCAC-305 (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) will be considered by the program. Exceptions may or may not be granted by the Graduate School.

Other admissions requirements include:

- **Statement of Purpose** – Applicants must describe how professional experience and goals align with the Certificate in Business Architecture, not to exceed 500 words.
- **Vita or Résumé** – Provide a one- to two-page listing of professional experience and education.
- **Application** – Completion of the Graduate School certificate application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>).

GRE/GMAT scores are NOT required.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
BA 809	Strategic Business Architecture	3
ENTR 810	Emerging Trends, Technology, and Corporate Innovation	3
EA 873	Enterprise Modeling	3
	or MBADM 571 Global Strategic Management	
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by

graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

- Graduates will be able to demonstrate competency in the foundational concepts and practices of effective enterprise modeling.
- Graduates will be able to demonstrate competency in developing and explaining different views of strategy development, strategy alignment, and strategy execution.
- Graduates will learn the major areas of concern that affect disruptive innovation.
- Graduates will be able to demonstrate the emerging trends and disruptors in technology and industry that create new markets and influence decision making, product development, business models, and business practices associated with innovation.
- Graduates will be able to demonstrate competency in the business motivations, business operations and business analysis frameworks and related networks that link these aspects of the enterprise together.
- Graduates will be able to demonstrate competency in developing and explaining different views of an organization that are typically developed in the practice of business architecture.

Contact

Campus	World Campus
Graduate Program Head	Brian Harold Cameron
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Brian Harold Cameron
Program Contact	Michelle Kristen Rockower mkk114@psu.edu (814) 865-5290
Program Website	View (https://www.worldcampus.psu.edu/degrees-and-certificates/business-architecture-certificate/overview/)

Business Management Foundations Graduate Credit Certificate Program

Graduate Program Head	Brian Cameron
Program Code	BMGFND
Campus(es)	World Campus

The Graduate Certificate in Business Management Foundations is offered by the Smeal College of Business. Most career fields today require a foundational business knowledge. The graduate certificate is a 12-credit program that can be completed in one calendar year. The graduate certificate provides foundational knowledge in key areas of business management.

Effective Semester: Spring 2021
Expiration Semester: Spring 2026

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate->

[admissions/how-to-apply/](https://gradschool.psu.edu/graduate-)). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Exceptions to GCAC-305 (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) will be considered by the program. Exceptions may or may not be granted by the Graduate School.

Other admissions requirements include:

- Official Transcripts – Submit official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>), regardless of the number of credits or semesters completed. Transcripts not in English must be accompanied by a certified translation.
- Application – Completion of the Graduate School certificate application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>).
- Statement of Purpose – Applicants must describe how professional experience and goals align with the Certificate in Business Management Foundations, not to exceed 500 words.
- Vita or Résumé – Provide a one- to two-page listing of professional experience and education.

GRE/GMAT scores are NOT required.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
Select 12 credits from the following:		12
BA 809	Strategic Business Architecture	
BA 888	Executive Leadership	
MBADM 571	Global Strategic Management	
MBADM 811	Financial Accounting	
MBADM 816	Managing and Leading People in Organizations	
MBADM 820	Financial Management	
MBADM 821	Marketing in a Global Environment	
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up

deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

- Graduates will be able to demonstrate competency in the foundational concepts and practices of business management.
- Graduates will be able to demonstrate competency in the concepts and practices in four of the following foundational areas of business management: (a) strategic management, (b) financial accounting, (c) financial management, (d) managing and leading people in organizations, (e) leadership. The four areas will be dependent on the student's background and needs.

Contact

Campus	World Campus
Graduate Program Head	Brian Harold Cameron
Program Contact	Michelle Kristen Rockower mkk114@psu.edu (814) 865-5290
Program Website	View (https://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-business-management-foundations-certificate/overview/)

Business Process Integration Graduate Credit Certificate Program

Person-in-Charge	Raghu Sangwan
Program Code	ISBPI_GCT
Campus(es)	Great Valley World Campus

The Graduate Certificate in Business Process Integration is a program for students who aim to pursue a career as a Business Analyst or IT Manager where skills will include responsibilities to analyze, architect, design, implement and manage the technical support aspects of an organizational IT system to meet the business needs.

Courses taken in the certificate program may be applied toward a master of science degree in Information Science, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards a graduate degree must apply and be admitted to that degree program. Admission to the graduate degree program is a separate step and is not guaranteed.

Effective Semester: Summer 2024

Expiration Semester: Summer 2029

Admission Requirements.

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/>

[gcac-300/gcac-305-admission-requirements-international-students/](https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/)) for more information.

1. The successful applicant is generally expected to have a minimum combined junior/senior grade-point average of 3.0 (B) on a 4.0 scale.
2. Courses taken in the certificate program may be applied toward Master of Software Engineering degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards the Master of Software Engineering must apply and be admitted to that degree program. Admission to the Master of Software Engineering graduate degree program is a separate step and is not guaranteed.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
INSC 526	Business Process Management and Integration	3
INSC 539	Information Science Emerging Topics	3
SWENG 568	Enterprise Integration	3
Total Credits		9

All courses must be completed with a minimum grade of C or better and an overall GPA of 3.0.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **KNOW:** Understand the essential business process management and integration within a given organization.
2. **APPLY/CREATE:** Design and develop viable enterprise integration solutions to address the needs of aligning IT systems and business processes, meeting business goals and objectives within an organization.

Contact

Campus	Great Valley
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Guanghua Qiu
Program Contact	Sharon V. Patterson svp40@psu.edu (610) 648-3318

Campus	World Campus
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Guanghua Qiu
Program Contact	Sharon V. Patterson svp40@psu.edu (610) 648-3318

Business Sustainability Strategy Graduate Credit Certificate Program

Person-in-Charge	Eric Foley
Program Code	BUSSUS
Campus(es)	World Campus

The Graduate Certificate in Business Sustainability Strategy (BSS) is offered by the Smeal College of Business. The BSS covers intermediate to advanced content for integrating sustainability into core business strategy and operations. The integration occurs by identifying and managing the environmental and social impacts of a business in order to drive profitability, reduce cost and risk, and build long-term value. BSS provides students with knowledge, skills, and practical tools for developing a sustainability strategy and measuring financial, environmental and social returns.

The nine-credit graduate certificate is aimed toward students that wish to further graduate study in the area of Business sustainability. Course content focuses on: (1) an exploration of sustainability and what it means to business regarding changes to the regulatory, consumer, and competitive landscape; (2) analysis of differences across a variety of domestic and international markets; (3) strategy development including external and internal analysis, employee engagement, governance, and ensuring sustainability is built in, not bolted on; and (4) the latest business models and sustainable design solutions to drive business value and environmental/social performance up and down the value chain.

Effective Semester: Spring 2024

Expiration Semester: Spring 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students

(<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Exceptions to GCAC-305 (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) will be considered by the program. Exceptions may or may not be granted by the Graduate School.

Other admissions requirements include:

- Statement of Purpose — Applicants must describe how professional experience and goals align with the Certificate in Business Sustainability Strategy, not to exceed 500 words.
- Vita or Résumé — Provide a one- to two-page listing of professional experience and education.
- Application — Completion of the Graduate School certificate application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>).

GRE/GMAT scores are NOT required.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
MGMT 811	Sustainability Strategy Development	3
SCM 813	Sustainable Supply Chain Management	3
Select 3 credits from the following courses:		3
MGMT 831	Strategy Implementation and Organizational Change	
MBADM 571	Global Strategic Management	
MBADM 816	Managing and Leading People in Organizations	
BA 888	Executive Leadership	
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

- Graduates will be able to make a general business case for sustainability

- Graduates will be able to make a specific business case for a particular proposed investment, initiative, product or process change
- Graduates will be able to develop a sustainability strategy for any size or type of company/organization from start-up to large incumbent multi-national corporation
- Graduates will be able to quantitatively and qualitatively assess opportunities in their supply chain
- Graduates will be able to create a strategy for incremental to transformative improvements to supply chain operations that result in greater business and social value
- Graduates will have the knowledge for leading organizational change for sustainability

Contact

Campus	World Campus
Graduate Program Head	Erik Blair Foley-Defiore
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Judd Harrison Michael
Program Contact	Michelle Kristen Rockower mkk114@psu.edu (814) 865-5290
Program Website	View (https://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-business-sustainability-strategy-certificate/overview/)

Business-to-Business Marketing Graduate Credit Certificate Program

Person-in-Charge	Meg Meloy
Program Code	B2BMKT
Campus(es)	World Campus

The Graduate Certificate in Business-to-Business Marketing is offered by the Smeal College of Business. The graduate certificate is a 9-credit program that can be completed in one calendar year.

Through the Certificate Program, students will gain a unique understanding of business markets that prepares them for a job in Business-to-Business (B2B) marketing. They will learn fundamental concepts, theories, and tools specific to B2B marketing strategy, B2B innovation, and B2B analytics. The certificate is focused on creating, delivering, and harvesting customer value. The focus on proven tools and frameworks, in close collaboration with the Institute for the Study of Business Markets, ensures close alignment with B2B marketing practice.

Effective Semester: Fall 2024

Expiration Semester: Fall 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/>

([gcac-300/gcac-305-admission-requirements-international-students/](https://gradschool.psu.edu/graduate-education-policies/gcac-300/gcac-305-admission-requirements-international-students/)) for more information.

Other admissions requirements include:

- **Application** – Completion of the Graduate School certificate application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>).
- **Statement of Purpose** – Submit a statement describing how professional experience and goals align with the certificate.
- **Vita or Resume** – a one-to-two-page listing of professional experience

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
MKTG 816	Business-to-Business Marketing Analytics	3
MKTG 817	New Product Development and Management	3
MKTG 818	Business-to-Business Marketing Strategy	3
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Gain a unique understanding of business markets that prepares the student for a job in B2B marketing at industrial firms (such as oil and gas, manufacturing, ICT), B2B service firms (such as software, digital technology solutions), and B2B digital natives (such as platform firms).
2. Understand the fundamental concepts, theories, and tools that are specific to B2B marketing, and apply them to develop a strategic marketing plan, and to create, deliver, and harvest customer value.
3. Understand and apply fundamental concepts of innovation and NPD, tools, frameworks, and qualitative/quantitative techniques to design an appropriate NPD approach and successfully manage the NPD process.
4. Understand how to leverage data and analytics to support B2B marketing decisions and realize B2B marketing success.

Contact

Campus	World Campus
Graduate Program Head	Meg Meloy
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Stefan Wuyts
Program Contact	Michelle Kristen Rockower mkk114@psu.edu (814) 865-5290

Children's Literature Graduate Credit Certificate Program

Person-in-Charge	Elisa Shaw Hopkins
Program Code	CHDLIT
Campus(es)	World Campus

The goal of the program is to provide students with an in-depth background in the theories and genres of literature for children and youth while also considering pedagogical (broadly construed) and cultural implications.

The program does not lead to any initial teacher certification, but may assist students with recertification. Students should check with their specific state departments of education for regulations regarding recertification. At least half of the course credits taken must be at the 500 or 800 level.

Effective Semester: Summer 2022

Expiration Semester: Summer 2027

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Students are required to take LLED 502 as a foundation to the various orientations to the study of children's literature. Students may choose a minimum of four additional courses in areas such as picture books, nonfiction literature, fantasy literature, myth and folklore, cultural and social issues, writing for children, theories of childhood, and research approaches for a total of 15 credits. At least half of the credits taken must be at the 500 or 800 level.

Code	Title	Credits
Required Course		
LLED 502	Studies in Literature for Children	3
Electives		
Choose a minimum of 12 elective credits from the following:		12
CI 560	Theories of Childhood	
LLED 462	The Art of the Picturebook	
LLED 464	Nonfiction Literature for Children and Adolescents	
LLED 465	Fantasy Literature for Children	
LLED 520	Literature for Adolescents	
LLED 561	Cultural Pluralism in Children's and Adolescent Literature	
LLED 563	Myths and Folktales in Children's Literature	
LLED 564	Writing for Children	
LLED 568	Doing Research in Children's Literature	
Total Credits		15

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

- Theories and Genres:** Develop and demonstrate an understanding of the theories and genres of literature for children and youths
- Childhood and Children's Literature:** Consider and discuss childhood as an idea and children's literature as a social project and cultural artifact
- Diversity and Social Justice:** Develop and demonstrate an understanding of issues of race, class, gender, and disability in children's literature
- Children's Literature in the Classroom and Beyond:** Consider and discuss pedagogical and cultural implications

Contact

Campus	World Campus
Graduate Program Head	Elisa Hopkins
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Kimberly Anne Powell
Program Contact	270B Chambers Bldg. Penn State University University Park PA 16802
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/childrens-literature-certificate/overview/)

Clinical Research Graduate Credit Certificate Program

Person-in-Charge	Cheryl Thompson
Program Code	HYCLRS
Campus(es)	Hershey

In the current medical climate, there is a growing need for academic clinicians and health care professionals who are trained in clinical research. Unfortunately, there are few programs that offer the didactic preparation for the unique requirements of a clinical researcher.

The primary goal of this program is to provide a formal, structured program that will prepare certificate candidates to pursue a successful career in clinical research. The curriculum includes courses in biostatistics, epidemiology, clinical trials, decision and cost-effectiveness analysis, outcomes measurement, quality management, health care economics and policy, scientific communication, and SAS statistical analysis computing. The 12-credit program offers courses on weekday evenings, enabling the student to continue clinical or employment activities. Certificate candidates will be able to complete the 12-credit requirement in 2 semesters.

Effective Semester: Fall 2020
Expiration Semester: Fall 2025

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

The successful applicant must have completed a medical, nursing, or baccalaureate degree from a regionally accredited institution. Fellows and junior faculty members with current appointments at the Penn State College of Medicine, as well as nursing graduates and public health personnel, are target candidates for the certificate program.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
PHS 520	Principles of Biostatistics	3

PHS 550	Principles of Epidemiology	3
PHS 519	Patient Centered Research	3

Electives

Select 3 credits from the following:		3
PHS 500	Research Ethics for Clinical Investigators	
PHS 518	Scientific Communication	
PHS 521	Applied Biostatistics	
PHS 529	Biostatistical Computing for Public Health	
PHS 535	Quality of Care Measurement	
PHS 536	Health Survey Research Methods	
PHS 540	Decision Analysis for Public Health	
PHS 551	Advanced Epidemiological Methods	
PHS 570	Health Economics and Economic Evaluation	
PHS 580	Clinical Trials: Design and Analysis	

Total Credits **12**

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

- Statistical tests:** Students will be able to understand basic statistical tests, and perform statistical inference.
- Statistical software:** Students will be able to use statistical software to conduct basic data analysis.
- Measures of disease frequency:** Students will be able to calculate and interpret measures of disease frequency and association in epidemiological studies.
- Analyzing epidemiological data:** Students will be able to conduct appropriate statistical analyses of epidemiological data and interpret the results.

Contact

Campus	Hershey Med Ctr
Graduate Program Head	Cheryl Thompson
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Li Wang

Program Contact
 Shannon Tuininga
 90 Hope Drive
 Public Health Sciences
 Hershey PA 17033
 smb611@psu.edu
 (717) 531-0003 Ext. 281150

Program Website
 View (<http://med.psu.edu/clinical-research-certificate/>)

Community and Economic Development Graduate Credit Certificate Program

Person-in-Charge	Laszlo Kulcsar
Program Code	CEDEV
Campus(es)	World Campus

The Graduate Certificate program in Community and Economic Development prepares student to confront the multidimensional challenges faced by community development practitioners. The main objective of the certificate program is to educate professionals who will assume leadership roles in helping establish and maintain viable communities. Recipients of the certificate will become deeply involved in assisting localities with a variety of issues, including: developing new organizations and new industries; growth management; protecting the environment; revitalizing downtown areas; enhancing the local quality of life; assisting educational, social, health and human service systems; and developing vital infrastructure—in short, working with communities to help them shape their own futures. The certificate program will teach the theory, skills and tools that allow practitioners to address the important issues in community and economic development. The certificate program emphasizes topical problems, drawing from the experiences of both students and the faculty. Students in Community and Economic Development gain a broad understanding of the dynamics of communities and their social, economic and political systems. With this training, recipients will have a wide range of career opportunities in an expanding job market. Some work for local or regional governments, industrial development authorities and chambers of commerce, major corporations, non-governmental organizations, or consulting firms. Others may work for development authorities, housing authorities, planning commissions or environmental planning and development agencies.

Effective Semester: Spring 2022

Ending Semester: Spring 2027

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Students with a 3.00 average (on a 4.00 scale) for the most recent two years of college/university education, or with an advanced degree, and with appropriate course and experiential backgrounds will be considered for admission.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/>).

[gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/](https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/)).

The Graduate Certificate in Community and Economic Development (CEDEV Certificate) requires 15 credits, consisting of five 3-credit courses. The CEDEV Graduate Certificate is designed to build a basic level of knowledge and skills required for practitioners to address the important issues in community and economic development.

The certificate program is designed primarily for professionals in the field who wish to expand their existing knowledge and for those who wish to learn about community and economic development, including those working in or interested in dealing with the variety of development issues in America's towns, boroughs, small cities and rural areas. All courses are delivered online through the Penn State World Campus.

The five required courses introduce students to the field and cover the topics of Principles of Community and Economic Development and Leadership, Rural Organization, Economic Development Planning, Population, Land Use and Municipal Finance, and Methods and Techniques of Community and Economic Development. Courses taken in the certificate program may be applied toward a graduate degree in Community and Economic Development, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards a graduate degree in Community and Economic Development must apply and be admitted to that degree program. Admission to the Community and Economic Development graduate degree program is a separate step and is not guaranteed.

Code	Title	Credits
Required Courses		
CEDEV 430	Principles of Local Economic Development	3
CEDEV 452	Community Structure, Processes and Capacity	3
CEDEV 500	Community and Economic Development: Theory and Practice	3
CEDEV 509	Population, Land Use, and Municipal Finance	3
CEDEV 575	Methods and Techniques for Community and Economic Development	3
Total Credits		15

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

Students will demonstrate an understanding of:

- 1. LOCAL COMMUNITY AND ECONOMIC DEVELOPMENT PLANNING:** Concepts, strategies and techniques of local economic analysis, planning, and development.
- 2. SOCIAL PROCESSES:** The social organization, processes and changes that define a community.

- PROBLEM SOLVING STRATEGIES:** Application of sociological and economic principles and strategies to problem solving in the community context.
- THEORIES AND PROCESSES:** Theories, concepts and framework of community and economic development within the framework of community decision-making models.
- GOVERNMENT FINANCING:** The interaction of population characteristics, land use, municipal funds and taxation and how they impact the management of local government jurisdictions.
- ANALYTICAL TECHNIQUES AND METHODS:** Application of research methodologies and data collecting, techniques to analyze and recommend solutions to community and economic development issues and problems.

Contact

Campus	World Campus
Graduate Program Head	Laszlo Kulcsar
Program Contact	Patricia Jo Spears-Taff 305 Armsby University Park PA 16802
Program Website	View (http://aese.psu.edu/graduateprograms/cedev/graduate-certificate-program/)

Computer Vision Graduate Credit Certificate Program

Person-in-Charge	Raghu Sangwan
Program Code	MAICV
Campus(es)	Great Valley World Campus

The Computer Vision Graduate Certificate prepares students for working as a CV Engineer responsible to analyze, identify, architect, design, and implement computer vision based systems. Students master the following skill set essential to this industry role:

- Identifying computer vision tasks
- Framing machine vision problems (image classification, objective detection, image segmentation, activity detection, etc.)
- Designing computer vision pipelines to collect and preprocess images and videos
- Building and evaluating computer vision models based on deep neural networks and statistical machine learning techniques
- Deploying computer vision models on cloud-based infrastructure, servers, and embedded devices

Courses taken in the certificate program may be applied toward a master's degree in Artificial Intelligence, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards a graduate degree must apply and be admitted to that degree program. Admission to the graduate degree program is a separate step and is not guaranteed.

Effective Semester: Spring 2024
Expiration Semester: Spring 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

- The successful applicant is generally expected to have a minimum combined junior/senior grade-point average of 3.0 (B) on a 4.0 scale.
- Courses taken in the certificate program may be applied toward Master of Software Engineering degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards the Master of Software Engineering must apply and be admitted to that degree program. Admission to the Master of Software Engineering graduate degree program is a separate step and is not guaranteed.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
DAAN 871	Data Visualization	3
A-I/DAAN 572	Reinforcement Learning	3
A-I 879	Machine Vision	3
Total Credits		9

All courses must be completed with a minimum grade of C or better and an overall GPA of 3.0.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

- KNOW** - Demonstrate proficiency in mastering foundational concepts in computer vision.
- APPLY/CREATE** - Demonstrate mastery of concepts and methods for modeling, designing, developing, and testing computer vision applications.

Contact

Campus	Great Valley
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Youakim Badr
Program Contact	Sharon V. Patterson 30 E. Swedesford Rd. Malvern PA 19355 svp40@psu.edu (610) 648-3318

Campus	World Campus
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Youakim Badr
Program Contact	Sharon V. Patterson 30 E. Swedesford Rd. Malvern PA 19355 svp40@psu.edu (610) 648-3318

Corporate Innovation and Entrepreneurship Graduate Credit Certificate Program

Person-in-Charge	Shawn M. Clark
Program Code	CIENT
Campus(es)	World Campus

The graduate certificate in Corporate Innovation and Entrepreneurship is a 12-credit online program for industry professionals who are interested in developing a knowledge base and skill set in the area of innovation and entrepreneurship in the corporate sector. The program focuses on all aspects of corporate innovation management, such as: ideation, product / service development, managing customer experiences, brand management, entrepreneurial leadership, innovation strategies and methods, developing innovative corporate cultures, leading innovative teams, benchmarking, competitor assessment, future trend tracking, new venture creation, and technology commercialization. The certificate is geared towards individuals working in small businesses, on up to and including global conglomerates, where innovation and continuous improvement are imperative. Individuals interested in launching startup companies will also find this program beneficial.

For students interested in furthering their understanding and knowledge of this field, a Master of Management in Corporate Innovation and Entrepreneurship is available by taking an additional 21 credits of advance study. Courses taken in the certificate program may be applied toward the M.Mgt. in Corporate Innovation and Entrepreneurship, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>). Certificate students who wish to have certificate courses applied towards the M.Mgt. in Corporate Innovation and Entrepreneurship must apply and be admitted to that degree program. Admission to the Corporate Innovation and Entrepreneurship graduate degree program is a separate step and is not guaranteed.

Effective Semester: Fall 2024

Expiration Semester: Fall 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Exceptions to GCAC-305 (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) will be considered by the program. Exceptions may or may not be granted by the Graduate School.

Along with the submission of the online application and the nonrefundable application fee, the following is required:

- Statement of Purpose – Applicants must describe how professional experience and goals align with the Certificate in Corporate Innovation and Entrepreneurship, not to exceed 500 words.
- Vita or Résumé – Provide a one- to two-page listing of professional experience and education.

GRE/GMAT scores are NOT required.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
MBADM 850	Corporate Innovation and Entrepreneurship	3
Select three of the following core courses:		
ENTR 502	Business Modeling and New Venture Creation	9
ENTR 810	Emerging Trends, Technology, and Corporate Innovation	

ENTR 820	Corporate Innovation Strategies and Entrepreneurial Methods
MGMT 870	Entrepreneurial Finance and Venture Funding
Total Credits	
12	

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Objectives

- Graduates will be able to demonstrate competency in understanding the foundational concepts, theories, tools, and language of corporate innovation and entrepreneurship.
- Graduates will learn the techniques involved in thinking creatively and strategically to support innovation.
- Graduates will be able to demonstrate competency in analyzing, developing, and assessing new business models in light of future trends and changing market conditions.
- Graduates will be able to demonstrate competency in the methods, practices, and activities associated with launching a new venture or startup and turning it into a viable business initiative.
- Graduates will be able to demonstrate competency in how to make an organization more innovative by leveraging business strategy, teams, processes, leadership, and corporate culture.

Contact

Campus	World Campus
Graduate Program Head	Shawn Clark
Program Contact	Michelle Kristen Rockower 220 Business Building University Park PA 16802 mkk114@psu.edu (814) 865-5290
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-corporate-innovation-and-entrepreneurship-certificate/overview/)

Counterterrorism Graduate Credit Certificate Program

Graduate Program Head	Lee Ann Banaszak
Program Code	CNTRTM
Campus(es)	World Campus

The Graduate Credit Certificate in Counterterrorism provides working professionals and others with social science based training to understand and address terrorism and other threats to U.S. homeland security. The Certificate emphasizes the development of core skills such as threat analysis, management, and reporting; basic data usage and presentation; the preparation of counterterrorism briefings and

reports; and the assessment of anti-terrorism strategies. Through the Certificate course work, students learn about the motives, threats, recruitment strategies, and operational tactics of terrorist organizations. The courses focus on key elements within counterterrorism, such as diagnosing the root causes of terrorism, identifying and using sources of data, critical data gathering and analysis skills, and radicalization processes. Certificate recipients will develop the capacity to identify conditions likely to encourage terrorism; define, evaluate, and assess counterterrorism techniques and operations; and turn collected data into actionable information. In this way, they will be prepared for leadership and supporting roles in the homeland security professional workforce. The Certificate is based around four courses that in turn form the core requirements for the Counterterrorism option within the online Intercollege Master of Professional Studies in Homeland Security.

Effective Semester: Summer 2023

Expiration Semester: Summer 2028

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Applicants must submit the following items with their application for admission to the Counterterrorism certificate program:

- official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>);
- resume/CV; and
- one-page statement of purpose or rationale for seeking a Graduate Certificate in Counterterrorism.

Applicants are expected to have a 3.0 or higher GPA in their undergraduate work.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
PLSC 569	Counterterrorism	3
PLSC 836	Root Causes of Terrorism	3

PLSC 837	Radicalization, Counter-Radicalization, and De-Radicalization	3
PLSC 838	Tools and Analysis of Counterterrorism	3
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Graduates will demonstrate knowledge about the foundational literature, theory, practice and current challenges surrounding Counterterrorism and Counterterrorism policy.
2. Graduates will demonstrate competence in utilizing and presenting relevant information, data and sources regarding Counterterrorism and Counterterrorism policy.
3. Graduates will demonstrate understanding of the professional, normative and ethical dimensions of Counterterrorism and Counterterrorism policy.

Contact

Campus	World Campus
Graduate Program Head	Lee Ann Banaszak
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Andrew Vitek
Program Contact	Allison Haas 220 Pond Laboratories University Park PA 16802 ajh38@psu.edu (814) 863-8110
Program Website	View (https://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-counterterrorism-certificate/overview/)

Cyber Threat Analytics and Prevention Graduate Credit Certificate Program

Person-in-Charge	Raghu Sangwan
Program Code	CTAP
Campus(es)	Great Valley World Campus

The Cyber Threat Analytics and Prevention 12-credit graduate certificate at Penn State Great Valley prepares students to understand the diverse and global cyberattacks, cyber laws and regulations, vulnerabilities, threats, and surveillance systems, while gaining certain fundamental skills to plan, prevent, protect, detect, analyze, respond, mitigate, and recover from threats and attacks in a sophisticated and large-scale basis.

Effective Semester: Summer 2024
Expiration Semester: Summer 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Students must maintain a minimum grade point average of 3.0 (B) throughout the program.

Code	Title	Credits
Required Courses		
INSC 831	Contemporary Information Systems Architecture	3
INSC 561	Web Security and Privacy	3
Electives		
Select at least two of the following:		6
DAAN 545	Data Mining	
DAAN 871	Data Visualization	
INSC 846	Network and Predictive Analytics for Socio-Technical Systems	
IST 454	Computer and Cyber Forensics	
IST 554	Network Management and Security	
IST 820	Cybersecurity Analytics	
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Effectively communicate cyber security knowledge, including vulnerability, threat, cyberattack analysis, and suspicious and attack findings in written formats in a manner appropriate to the audience.
2. Collect and Analyze data to uncover, detect, and analyse network suspicious activities and cyberattacks.
3. Demonstrate understandings and skills to plan, protect, respond, mitigate, and recover from cyber threats and attacks.

Contact

Campus	Great Valley
Graduate Program Head	Guanghua Qiu
Program Contact	Sharon V. Patterson svp40@psu.edu (610) 648-3318
Campus	World Campus
Graduate Program Head	Guanghua Qiu
Program Contact	Sharon V. Patterson Penn State Great Valley 30 East Swedesford Road Malvern PA 19355 svp40@psu.edu (610) 648-3318
Program Website	View (https://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-cyber-threat-analytics-prevention-certificate/overview/)

Data Analytics and Engineering Graduate Credit Certificate Program

Person-in-Charge	Raghu Sangwan
Program Code	MSEDAE
Campus(es)	Great Valley World Campus

The Graduate Certificate in Data Analytics and Engineering is a program for students who aim to pursue a career in Data Architecture where skills will include responsibilities in designing, building, and maintaining infrastructure for managing and analyzing large volumes of data. Students develop knowledge and skills in programming, data modeling and design, data integration, and data warehousing. A certificate will be awarded upon completion of the courses.

Courses taken in the certificate program may be applied toward a master's degree in Software Engineering, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards a graduate degree must apply and be admitted to that degree program. Admission to the graduate degree program is a separate step and is not guaranteed.

Effective Semester: Spring 2024
Expiration Semester: Spring 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/>

[gcac-300/gcac-305-admission-requirements-international-students/](#)) for more information.

1. The successful applicant is generally expected to have a minimum combined junior/senior grade-point average of 3.0 (B) on a 4.0 scale.
2. Courses taken in the certificate program may be applied toward Master of Software Engineering degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards the Master of Software Engineering must apply and be admitted to that degree program. Admission to the Master of Software Engineering graduate degree program is a separate step and is not guaranteed.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
DAAN 825	Large-Scale Database and Warehouse	3
DAAN 862	Analytics Programming in Python	3
SWENG 545	Data Mining	3
IE 575	Foundations of Predictive Analytics	3
Total Credits		12

All courses must be completed with a minimum grade of C or better and an overall GPA of 3.0.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Analyze large amounts of data to predict future trends and events, and discover patterns and find insights.
2. Architect, implement, and monitor data pipelines to create robust data solutions.

Contact

Campus	Great Valley
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Raghu Sangwan
Program Contact	Sharon V. Patterson 30 E. Swedesford Rd. Malvern PA 19355 svp40@psu.edu (610) 648-3318

Campus	World Campus
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Raghu Sangwan
Program Contact	Sharon V. Patterson 30 E. Swedesford Rd. Malvern PA 19355 svp40@psu.edu (610) 648-3318

Data Analytics Graduate Credit Certificate Program

Person-in-Charge	Raghu Sangwan
Program Code	DAANG
Campus(es)	Great Valley World Campus

The Graduate Certificate in Data Analytics is a program for students who aim to pursue a career as a Data Analyst, Information Officer, or Quantitative Analyst and be responsible to presents data in visual and meaningful ways, create analytics solutions for business problems, use data to determine optimal solutions for business problems, provide technical leadership on data-related activities, and use quantitative methods to support business decisions.

Courses taken in the certificate program may be applied toward a master's degree in Data Analytics, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards a graduate degree must apply and be admitted to that degree program. Admission to the graduate degree program is a separate step and is not guaranteed.

Effective Semester: Spring 2024
Expiration Semester: Spring 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/>

[gcac-300/gcac-305-admission-requirements-international-students/](https://gradschool.psu.edu/graduate-education-policies/gcac-300/gcac-305-admission-requirements-international-students/)) for more information.

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Applicants with undergraduate degrees in a quantitative discipline such as science, engineering, or business may apply. Students from other disciplines will be considered based on prior coursework. Applicants are generally expected to have a minimum combined junior/senior grade-point average of 3.0 (B) on a 4.0 scale.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
DAAN 846	Network and Predictive Analytics for Socio-Technical Systems	3
DAAN 871	Data Visualization	3
DAAN 881	Data-Driven Decision Making	3
Total Credits		9

All courses must be completed with a minimum grade of C or better and an overall GPA of 3.0.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Objectives

1. KNOW - Using analytical techniques, including end-to-end data analysis, descriptive and perspective analytics techniques, to extract information from data and to help people make better decisions.
2. APPLY/CREATE - To introduce the principles of network and predictive analytics for analyzing the interrelatedness of cyber-social and cyber-technical aspects of the society.

3. APPLY/CREATE - To introduce the principles, concepts, techniques and tools for visualizing information in large complex data sets.

Contact

Campus	Great Valley
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Adrian Sorin Barb
Program Contact	30 East Swedesford Road Malvern PA 19355
Program Website	View (http://greatvalley.psu.edu/academics/graduate-certificates/data-analytics/)

Campus	World Campus
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Adrian Sorin Barb
Program Contact	Sharon V. Patterson svp40@psu.edu (610) 648-3318

Data Engineering for Analytics Graduate Credit Certificate Program

Person-in-Charge	Raghu Sangwan
Program Code	MDADEA
Campus(es)	Great Valley World Campus

The Graduate Certificate in Data Engineering for Analytics is a program for students who aim to pursue a career as a Data Engineer or Information Technology Officer and be responsible to architect, implement, and monitor data pipelines, assess requirements, apply relevant techniques to create robust data solutions, oversee the development of new information systems, plan, design, and deploy an enterprise virtual infrastructure.

Courses taken in the certificate program may be applied toward a master's degree in Data Analytics, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards a graduate degree must apply and be admitted to that degree program. Admission to the graduate degree program is a separate step and is not guaranteed.

Effective Semester: Spring 2024
Expiration Semester: Spring 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/>

([gcac-300/gcac-305-admission-requirements-international-students/](https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/)) for more information.

1. The successful applicant is generally expected to have a minimum combined junior/senior grade-point average of 3.0 (B) on a 4.0 scale.
2. Courses taken in the certificate program may be applied toward Master of Software Engineering degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards the Master of Software Engineering must apply and be admitted to that degree program. Admission to the Master of Software Engineering graduate degree program is a separate step and is not guaranteed.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
DAAN 822	Data Collection and Cleaning	3
DAAN 825	Large-Scale Database and Warehouse	3
DAAN 826	LARGE SCALE DATABASES FOR REAL-TIME ANALYTICS	3
Total Credits		9

All courses must be completed with a minimum grade of C or better and an overall GPA of 3.0.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **KNOW** - Develop and integrate big data systems for analyzing large volumes of data to discover patterns and find insights.
2. **APPLY/CREATE** - Architect, implement, and test big data pipelines to create robust data warehouse solutions.
3. **APPLY/CREATE** - Architect, implement, and test big data pipelines to create robust real-time solutions.

Contact

Campus	Great Valley
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Adrian Sorin Barb
Program Contact	Sharon V. Patterson 30 E. Swedesford Rd. Malvern PA 19355 svp40@psu.edu (610) 648-3318

Campus	World Campus
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Adrian Sorin Barb
Program Contact	Sharon V. Patterson 30 E. Swedesford Rd. Malvern PA 19355 svp40@psu.edu (610) 648-3318

Dietetic Internship Postbaccalaureate Credit Certificate Program

Person-in-Charge	Denise Lawson
Program Code	DIETIN
Campus(es)	University Park

Penn State's Dietetic Internship Program is a post baccalaureate, general, supervised practice program. The internship program is structured according to the Accreditation Council for Education in Nutrition and Dietetics (ACEND) Accreditation Standards for Nutrition and Dietetic Internship Programs (DI). Upon completion of the program, students are eligible to take the registration examination to obtain the Registered Dietitian Nutritionist (RDN)/Registered Dietitian (RD) certification administered by the Commission on Dietetic Registration.

Effective Date: Summer 2023

Expiration Date: Summer 2028

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Students who have completed a baccalaureate degree and hold a valid Verification Statement from a Didactic Program in Dietetics (DPD) may submit an application for consideration.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Students are required to complete the following graduate-level credits earning a grade a "B" or better.

Code	Title	Credits
Required Courses		
NUTR 595A	Application of Community Nutrition – Internship	3
NUTR 595B	Application of Food Service Management – Internship	3
NUTR 595C	Dietetic Enrichment Experience - Dietetic Internship	1
NUTR 595D	Application Clinical Nutrition – Internship	6
NUTR 595E	Introduction to Nutrition Research -- Internship	1
NUTR 595F	Professional Portfolio Internship	1
Total Credits		15

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Objectives

The internship program is structured according to the Accreditation Council for Education in Nutrition and Dietetics (ACEND) Accreditation Standards for Nutrition and Dietetic Internship Programs (DI). Learning objectives include:

1. Conduct projects using appropriate research methods, ethical procedures and data analysis.
2. Demonstrate professional attributes in all areas of practice.
3. Demonstrate effective communication skills for clinical and customer services in a variety of formats.
4. Perform management functions related to safety, security and sanitation that affect employees, customers, patients, facilities and food.

Contact

Campus	University Park
Graduate Program Head	Denise Conforti Lawson
Program Contact	Denise Conforti Lawson 110 Chandlee Lab University Park PA 16802 dmc209@psu.edu (814) 865-9150
Program Website	View (http://nutrition.hhdev.psu.edu/internship/)

Distance Education Postbaccalaureate Credit Certificate Program

Person-in-Charge	Susan Land
Program Code	DISTED
Campus(es)	World Campus

The certificate in Distance Education is a postbaccalaureate program designed for educators, administrators, and trainers who want to expand their knowledge and build competencies in the field of distance education, online learning, and open education. The program provides a systems view of how to structure successful distance learning experiences for higher education, corporate, healthcare, military, non-profit, K-12, and community-based settings. The goal of the program is to provide a solid historical foundation and to assist students in learning the latest trends, issues, research, design, and applications within the field of distance education - while experiencing them firsthand as a student.

Effective Semester: Fall 2021
Expiration Semester: Fall 2026

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Applicants must submit the following materials:

- A one-page resume
- A statement describing professional goals, experiences, and responsibilities (2 page maximum)
- One letter of recommendation
- Official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>)

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

The certificate program consists of 9 credits of course work in Lifelong Learning and Adult Education (ADTED) of which 6 credits must be at the 500 level.

Code	Title	Credits
Required Courses		
ADTED 470	Introduction to Distance Education	3

ADTED 531	Course Design and Development in Distance Education	3
ADTED 532	Research and Evaluation in Distance Education	3
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Contact

Campus	World Campus
Graduate Program Head	Susan Land
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Heather Toomey Zimmerman
Program Contact	Whitney A DeShong 303 Keller Building University Park PA 16802 wad5021@psu.edu (814) 865-0473
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/distance-education-certificate/overview/)

Diversity and Inclusion as Strategy Graduate Credit Certificate Program

Person-in-Charge	Vilmos Misangyi
Program Code	DVINST
Campus(es)	World Campus

The Graduate Certificate in Diversity and Inclusion as Strategy is offered by the Smeal College of Business. The graduate certificate positions students to approach Diversity, Equity and Inclusion (DEI) as a strategic leadership capability. Through this certificate program students will develop the core skills and competencies needed to manage diversity effectively as well as to lead or implement diversity related change initiatives successfully.

Effective Semester: Spring 2024
Expiration Semester: Spring 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/>)

gcac-300/gcac-305-admission-requirements-international-students/) for more information.

For admission to the Graduate School, an applicant must hold either (1) a baccalaureate degree from a regionally accredited U.S. institution or (2) a tertiary (postsecondary) degree that is deemed comparable to a four-year bachelor's degree from a regionally accredited U.S. institution. Other admissions requirements include:

Application – Completion of the Graduate School certificate application (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>).

Statement of Purpose – Submit a statement describing how professional experience and goals align with the certificate.

Vita or Resume – a one-to-two-page listing of professional experience

GRE or GMAT test scores are NOT required.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
MGMT 845	Leading Diverse Organizations	3
Additional Courses		
Select 6 credits from the following courses:		
MGMT 831	Strategy Implementation and Organizational Change	3
BA 804	Ethical Leadership	3
BA 835	Global Perspectives	2
BA 836	Global Immersion	1
BA 888	Executive Leadership	3
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Apply evidence-based approaches to resolving diversity dilemmas at work
2. Analyze organizational culture to ensure that it is conducive to managing diversity effectively
3. Apply the framework for leading the change process
4. Discuss the concept of values (personal, organizational, cultural), and how values relate to ethical decision making, ethical leadership, and ethical culture.

5. Discuss the concepts of corporate social responsibility, sustainability, stakeholder analysis, and crisis management, and apply those to specific cases.

Contact

Campus	World Campus
Graduate Program Head	Vilmos Misangyi
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Aparna Anand Joshi
Program Contact	Michelle Kristen Rockower mkk114@psu.edu (814) 865-5290
Program Website	View (https://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-diversity-and-inclusion-as-strategy-graduate-certificate/)

Diversity, Ethics, and Leadership Postbaccalaureate Credit Certificate Program

Person-in-Charge	Paul Clark
Program Code	DVETHL
Campus(es)	University Park

In today's dynamic and interconnected world, organizations face complex challenges related to leadership in the fields of human resource management and employment relations. The 9-credit Post Baccalaureate Certificate in Leadership in HRER is designed to empower professionals with the knowledge and skills to navigate these challenges, foster inclusive environments, and lead ethically in diverse settings.

Courses taken in the certificate program may be applied toward a master's degree in HRER, subject to restrictions outlined in [GCAC-309 Transfer Credit](#). Certificate students who wish to have certificate courses applied towards a graduate degree in HRER must apply and be admitted to that degree program. Admission to the HRER graduate degree program is a separate step and is not guaranteed.

Effective Semester: Spring 2024

Expiration Semester: Spring 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

- Applicants with a 3.00 junior/senior grade-point average (on a 4.00 scale) will be considered for admission. Exceptions to the minimum grade-point average may be made at the discretion of the program for students with special backgrounds, abilities, and interests;

- All applicants submit a Graduate School application (including payment of the nonrefundable application fee), resume, and personal statement addressing their reasons for pursuing a certificate in diversity, ethics, and leadership.
- The resume and personal statement are waived if a student is currently enrolled in the MHRER or MS HRER degree programs.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

All courses must be completed with a grade of C or better and a grade-point average of 3.0 to be awarded the certificate.

Code	Title	Credits
Required Courses		
HRER 865	Diversity and Ethics in the Workplace	3
LHR 464	Communication Skills for Leaders in Groups and Organizations	3
LHR 465 or LHR 409	Collective Decision Making Leadership Development: A Life-Long Learning Perspective	3
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **Know:** Graduates will have and be able to demonstrate the necessary advanced knowledge and competence in diversity, ethics, and leadership to excel in their careers.
2. **Think:** Graduates will be able to recognize and analyze practical, legal, and ethical challenges related to diversity, ethics, and leadership issues in workplaces.
3. **Apply/Create:** Graduates will be able to conduct independent inquiries to identify current scholarship and best practices and effectively apply relevant theories and practices when solving problems related to diversity, ethics, and leadership.
4. **Communicate:** Graduates will be able to effectively communicate knowledge of current topics to excel as professionals in diversity, ethics, and leadership.
5. **Professional Practice:** Graduates should display behavior consistent with the highest ethical standards related to diversity, ethics, and leadership.

Contact

Campus	University Park
Graduate Program Head	Paul Clark
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Paul Clark
Program Contact	Erin Hetzel 506 Keller Building University Park PA 16802 eab27@psu.edu (814) 867-4167

e-Learning Design Graduate Credit Certificate Program

Person-in-Charge	Susan Land
Program Code	ELEARN
Campus(es)	World Campus

Through this 12-credit certificate program, students will develop an understanding of design issues and technologies needed to deliver online teaching and learning experiences for adults. Students completing this certificate will be prepared to work in corporate, agency, and military training departments; entrepreneurial consulting companies; adult-serving non-profits, community college learning resource centers; and colleges and universities.

Effective Semester: Summer 2021

Expiration Semester: Spring 2026

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
LDT 415A	Systematic Instructional Development	3
LDT 467	Emerging Web Technologies and Learning	3
ADTED 531	Course Design and Development in Distance Education	3
LDT 832	Designing e-learning Within Course Management Systems	3
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

Breadth and Depth of Disciplinary Knowledge – Students who complete the Postbaccalaureate Certificate in e-Learning Design will demonstrate their ability to design and develop instructional content that is aligned with the needs and constraints of the target learner audience, the sponsoring organization, the topics to be covered, and the available technology to enhance learning.

Contact

Campus	University Park
Program Contact	
Campus	World Campus
Graduate Program Head	Susan Land
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Heather Toomey Zimmerman
Program Contact	Darlene G Glab 301 Keller Building University Park PA 16802 dgg11@psu.edu (814) 863-9768
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-e-learning-design-certificate/overview/)

Educating Individuals with Autism Postbaccalaureate Credit Certificate Program

Person-in-Charge	Pamela Wolfe
Program Code	AUTISM
Campus(es)	World Campus

The focus of this post-baccalaureate certificate program is to provide comprehensive, evidence-based information on creating effective educational programming for individuals with autism spectrum disorders. After completing the 12-credit program, students will be able to:

- assess individuals with autism spectrum disorders to effectively provide instruction;
- develop strategies to enhance social, behavioral, communication, and academic gains;
- strengthen professional skills to work with families; and
- develop professional competencies to work with other educators and personnel in related disciplines.

Effective Semester: Summer 2022
Expiration Semester: Summer 2027

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
SPLD 461	Introduction to Autism Spectrum Disorders: Issues and Concerns	3
SPLD 462	Autism and Applied Behavior Analysis	3
SPLD 463	Communication and Social Competence	3
SPLD 464	Assessment and Curriculum	3
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **EBP:** Students will be able to define, apply, and explain evidence based practices in the field of Autism Spectrum Disorders.
2. **ASSESSMENT:** Students will be able to assess individuals with autism spectrum disorders to effectively provide instruction.
3. **STRATEGIES:** Students will be able to develop strategies to enhance social, behavioral, communication, and academic gains in individuals with autism.
4. **FAMILY:** Students will be able to display professional skills to work with families of individuals with autism.
5. **PROF COMPETENCIES:** Students will develop professional competencies to work with other educators and personnel in related disciplines.

Professional Licensure/Certification

Many U.S. states and territories require professional licensure/certification to be employed. If you plan to pursue employment in a licensed profession after completing this program, please visit the

Professional Licensure/Certification Disclosures by State (<https://www.psu.edu/state-licensure-disclosures/>) interactive map.

Contact

Campus	World Campus
Graduate Program Head	Pamela S Wolfe
Program Contact	Paul Smith 125 CEDAR Building University Park PA 16802 pms5249@psu.edu (814) 863-4452
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/autism-certificate/overview/)

Educational Technology Integration Postbaccalaureate Credit Certificate Program

Person-in-Charge	Susan Land
Program Code	EDTECH
Campus(es)	World Campus

This 15-credit certificate program prepares educators and instructional design professionals who want to advance their skills in the design, development, and implementation of technology-based learning experiences.

Effective Semester: Spring 2020
Expiration Semester: Spring 2025

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Students choose LDT 415A or LDT 415B to match the professional context in which they want to apply the skills learned in the program. The remaining twelve credits of the program can be chosen to best meet the individual interests, needs, and goals of the learner. In these courses, the intended professional context is addressed by the choice of projects.

Code	Title	Credits
Required Courses		
LDT 415A	Systematic Instructional Development	3
or LDT 415B	Systematic Instructional Development for Teachers	
Select four of the following:		12
LDT 440	Educational Technology Integration	
LDT 467	Emerging Web Technologies and Learning	
LDT 566	Computers as Learning Tools	
LDT 527		
LDT 505	Integrating Mobile Technologies into Learning Environments	
LDT 550	Learning Design Studio	
Total Credits		15

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Contact

Campus	World Campus
Graduate Program Head	Susan Land
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Heather Toomey Zimmerman
Program Contact	Darlene G Glab Learning and Performance Systems Department 303 Keller Building University Park PA 16802-1303 dgg11@psu.edu (814) 863-9768
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/educational-technology-integration-certificate/overview/)

Electrical Engineering Post-Baccalaureate Credit Certificate Program

Person-in-Charge	Robert A. Gray
Program Code	EE
Campus(es)	World Campus

The Electrical Engineering Post-Baccalaureate Credit Certificate provides working professionals specific electrical engineering subject knowledge or an additional breadth of electrical engineering knowledge that can support career goals or needs. This certificate provides flexibility for students to choose online technical electives that best suit their needs, without stipulation of required courses. Nine (9) electrical engineering course credit hours with a 'C' or better are required. All completed

electrical engineering certificate courses with a grade of 'B' or better can be applied to the Electrical Engineering M.Eng. degree program offered through World Campus, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards a graduate degree in Electrical Engineering must apply and be admitted to that degree program. Admission to the Electrical Engineering graduate degree program is a separate step and is not guaranteed. Students who earn the electrical engineering certificate with an overall GPA of 3.0 are encouraged to apply for the Electrical Engineering M.Eng. program offered through World Campus and will not need to submit letters of reference with their application. Electrical engineering technical elective subjects include: power systems, electronic communication systems, control systems and signal processing.

Effective Semester: Fall 2021

Expiration Semester: Fall 2026

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

It is expected that students have an ABET accredited Bachelor of Science degree in Electrical Engineering (BSEE) with a GPA of at least 3.0 in the final two years of school. Admission decisions will also be based on relevant transcripts, personal statement, work experience, and recommendation letters.

Those applying for admission in the Electrical Engineering certificate program without an ABET accredited Bachelor of Science in electrical engineering (BSEE) degree may be accepted with a strong background in mathematics and evidence that they meet the prerequisites to selected certificate courses. Note: The online electrical engineering certificate does not offer online prerequisite courses.

Prerequisite math courses for students who have not earned a Bachelor of Science in Electrical Engineering degree are: Calculus I, Calculus II, Calculus III (Multivariate calculus), Differential Equations, Complex Numbers and Probability/Statistics. Evidence to meet certificate prerequisite courses may include: Electromagnetics, Electrical Communications, Control System Design, Digital Signal Processing, Power/Machines, Signal and Systems (Fourier and Laplace transforms), Physics (Calculus based), Computer Programming (C,C++ or equivalent), Electrical Circuits (Calculus based) and Electronic Circuits. It is also very helpful to have some experience in MATLAB programming. All applicants are expected to have earned a junior/senior grade point average of 3.0 or higher.

Note: Technology degrees in electrical engineering, (for example, BSEET) are generally not an equivalent BSEE degree and therefore not accepted; applicants with a technology degree must meet all deficiency requirements and prerequisites to be considered.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Minimum credits is nine (9). Minimum overall GPA is 2.0. Time limitation is five (5) years.

Code	Title	Credits
Required Courses		
Select 9 credits from the following:		9
EE 460	Communication Systems II	
EE 480	Linear Systems: Time Domain and Transform Analysis	
EE 488	Power Systems Analysis I	
EE 531	Engineering Electromagnetics	
EE 553	Topics in Digital Signal Processing	
EE 560	Probability, Random Variables, and Stochastic Processes	
EE 580	Linear Control Systems	
EE 581	Optimal Control	
EE 588	Power System Control and Operation	
EE 589	Smart Grid Control and Dynamics	
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **KNOWLEDGE.** Graduates will be able to demonstrate understanding of principles in electrical engineering knowledge in either a broad sense of electrical engineering topics or focused subject area.
2. **CRITICAL THINKING.** Graduates will be able to conceptualize, evaluate and formulate electrical engineering problems, as well as perform the analyses required for problem defining and solving.
3. **PROBLEM SOLVING.** Graduates will be able to apply advanced knowledge, techniques, skills and use software simulation to solve electrical engineering problems.
4. **COMMUNICATE.** Graduates will be able to effectively communicate, using Penn State online learning resources, their solutions to electrical engineering problems, including the use of software simulation tools such as MATLAB.
5. **PROFESSIONALISM.** Graduates will be able to demonstrate professionalism, including the accomplishment of timely assignments and professional communication.

Contact

Campus	World Campus
Graduate Program Head	Vahid Motevalli
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Robert A. Gray
Program Contact	Kelly Batche W256 Olmsted - Penn State Harrisburg 777 West Harrisburg Pike Middletown PA 17057 klb68@psu.edu (717) 948-4349
Program Website	View (https://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-electrical-engineering-certificate/overview/)

Engineering Leadership and Innovation Management Graduate Credit Certificate Program

Person-in-Charge	David Mazyck
Program Code	ELIM
Campus(es)	University Park World Campus

The primary goal of the Engineering Leadership and Innovation Management certificate program is to provide professionals with the knowledge and skills in the key aspects of engineering business: leading teams, identifying new business opportunities, working across international and cultural boundaries, effectively managing projects, and promoting internal innovation. The certificate program highlights the changing nature of the field of Engineering, impacted by globalization and the importance of intercultural competencies and innovation management in the workforce. Upon completion of the certificate, students will have developed attributes required by today's successful engineering leaders. Specifically, these include improved ability to lead technical teams and expanded professional skills in leadership, intercultural competence, and innovation management within the engineering profession. The twelve-credit certificate program is built from the College of Engineering approved Engineering Leadership and Innovation Management (ELIM) graduate degree program.

Effective Semester: Spring 2022

Ending Semester: Spring 2027

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/>)

[gcac-300/gcac-305-admission-requirements-international-students/](#)) for more information.

Applicants must hold a baccalaureate degree in engineering, science, or a related discipline.

Applicants must have a 3.0 minimum undergraduate GPA (or equivalent). Exceptions to the minimum 3.0 grade-point average may be made for students with special backgrounds, abilities, and interests. Applicants to the Engineering Leadership and Innovation Management (ELIM) certificate must submit the following materials:

- Penn State Graduate School application form (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) and nonrefundable application fee;
- A Leadership and Innovation Personal Statement that includes a statement of career and educational goals including documentation of a minimum of one year of related full-time work. Students wishing to enter the program directly from an undergraduate degree can fulfill the 1-year requirement for work experience through summer internships, summer employment, or co-op experiences plus additional experience within professional societies. Justification for this experience should be included in the Leadership and Innovation Personal Statement. The statement should be an essay (2-3 pages in length) that demonstrates the applicant's written communication skills.
- Submission of a resume
- Submission of official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>).

Admissions decisions for the program are based on the quality of the applicant's credentials. The decisions are based on a review of the complete application portfolio. During the admission process, students who appear to be better suited for another graduate level program will be encouraged to apply to the appropriate program. Graduate Record Examination (GRE) scores are not required.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
ENGR 501	Engineering Leadership for Corporate Innovation	3
ENGR 802	Engineering Across Cultures and Nations	3
ENGR 804	Engineering Product Innovation	3
ENGR 405	Project Management for Professionals ¹	3
Total Credits		12

¹ Related project management specific courses may be substituted for ENGR 405 per approval by the ELD office.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by

graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Objectives

1. **Engineering Leadership:** Students will be able to describe leadership within the context of engineering and evaluate leadership strategies for corporate innovation.
2. **Innovation Management:** Students will be able to identify, promote, and lead opportunities for new products and businesses in alignment with an organization's strengths and weaknesses within an existing business structure.
3. **Cross Cultural Leadership:** Students will be able to demonstrate an understanding of cultural and international boundaries, effectively considering the implications of cultural and international business differences on project implementation.

Contact

Campus University Park
Graduate Program Head David William Mazyck
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC) Dena Lang
Program Contact Mariah L Germello
 mld5449@psu.edu
 (814) 865-2771

Campus World Campus
Graduate Program Head David William Mazyck
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC) Dena Lang
Program Contact Mariah L Germello
 115 Henning Building
 University Park PA 16802
 mld5449@psu.edu
 (814) 865-2771

Program Website View (<http://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-engineering-leadership-innovation-management-certificate/overview/>)

English as a Second Language Program Specialist Postbaccalaureate Credit Certificate Program

Person-in-Charge Mari Haneda
Program Code ESL
Campus(es) Berks
 University Park

The postbaccalaureate ESL Program Specialist Certificate is designed to give teachers the essential knowledge and skills to effectively work with English learners, their families, and communities in public school (K-12)

contexts. Students are required to take five three-credit courses which correspond to the ESL Program Specialist K-12 Program Guidelines of the Pennsylvania Department of Education. It involves 15 credit hours of course work, including 60 hours of integrated field experience. The program will lead to demonstration of knowledge of the fundamental concepts and teaching practices of English as a Second Language instruction and services to the growing numbers of English learners in public schools.

Effective Semester: Summer 2023

Expiration Semester: Spring 2028

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Applicants to the English as a Second Language certificate program must have a minimum TOEFL score of 100 with a 23 on the speaking section for the Internet-based test (iBT), or a 600 on the paper-based test.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

The program is a joint offering of the Department of Curriculum and Instruction in the College of Education and the Department of Applied Linguistics in the College of the Liberal Arts at The Pennsylvania State University.

Code	Title	Credits
Required Courses		
WLED 400	Foundations of Language in Second Language Teaching	3
WLED 444	Language, Culture and the Classroom: Issues for Practitioners	3
APLNG 484	Discourse-Functional Grammar	3
APLNG 493	Teaching English as a Second Language	3
WLED 483	Evaluating Schools Performances and Programs with English Language Learners (ELLs)	3
Total Credits		15

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up

deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **English Language Development:** Develop and demonstrate an understanding of English language structure, different varieties of English, and vocabulary development.
2. **Diversity, Community, and Equity:** Demonstrate an understanding of the impact of language and culture in the educational experiences of linguistically and culturally diverse students.
3. **Language Teaching Pedagogy:** Plan, differentiate, and demonstrate student-centered teaching using Second Language Acquisition principles and effective Second Language teaching practices.
4. **Assessment:** Use multiple and appropriate formative and summative assessment measures for a variety of purposes, including classroom and student self-assessment and technology-based assessment.
5. **Professionalism:** Conduct and integrate appropriate ESL research into planning and teaching; collaborate productively with other teachers; understand and articulate the legal basis and requirements for ESL services; and pursue professional development opportunities.

Professional Licensure/Certification

Many U.S. states and territories require professional licensure/certification to be employed. If you plan to pursue employment in a licensed profession after completing this program, please visit the Professional Licensure/Certification Disclosures by State (<https://www.psu.edu/state-licensure-disclosures/>) interactive map.

Contact

Campus	Berks
Graduate Program Head	Mari Haneda
Program Contact	270B Chambers Building University Park PA 16802
Program Website	View (https://ed.psu.edu/esl-specialist/)
Campus	University Park
Graduate Program Head	Mari Haneda
Program Contact	Dept. Plant Science, 101 Tyson Building Penn State University University Park PA 16802
Program Website	View (https://ed.psu.edu/esl-specialist/)

Enterprise Architecture Graduate Credit Certificate Program

Person-in-Charge	Carleen Maitland
Program Code	ENTARC
Campus(es)	World Campus

The certificate in Enterprise Architecture (EA) is designed to provide an introduction to EA and increase the knowledge of professionals seeking advanced leadership roles within an organization. EA strives to align the enterprise information systems and technology with business strategy

and goals to enable the most effective use of technology to both support and grow an organization.

The certificate program is an attractive option not only for those who desire advanced education and do not want a full Master's Degree program, but also for students who might want to take a certificate to determine if they are interested in a complete professional graduate degree program in Enterprise Architecture and Business Transformation. Up to 15 credits of Penn State course work taken in non-degree status may count towards a graduate degree in EA, but completion of the course work neither implies nor guarantees admission to a graduate degree program at Penn State. Courses taken in the certificate program may be applied toward a graduate degree in Enterprise Architecture, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>). Certificate students who wish to have certificate courses applied towards a graduate degree in Enterprise Architecture and Business Transformation must apply and be admitted to that degree program. Admission to the Enterprise Architecture and Business Transformation graduate degree program is a separate step and is not guaranteed.

Effective Semester: Fall 2023

Expiration Semester: Fall 2028

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

A bachelor's degree in a related area (e.g., information sciences, business architecture, or computer science), while not required, is helpful in the successful completion of the certificate. It is expected that students will have a foundation in information technology or enterprise architecture with a minimum of two (2) years of relevant professional work experience. Applicants with less than two years of relevant professional work experience may be considered but may be required to take prerequisite courses. For admission to the certificate, a 2.75 GPA, either overall or from the last 60 undergraduate credits, is needed. GRE scores are not required for non-degree graduate students.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

The certificate is highly flexible and is designed to meet the different needs of students and organizations. The courses are delivered online through the World Campus. With online delivery, the certificate can easily fit into the work schedule of professionals from around the globe.

All candidates are required to complete nine (9) credits.

Code	Title	Credits
Required Courses		
EA 871	Enterprise Architecture Foundations I	3
EA 873	Enterprise Modeling	3
EA 874	Enterprise Information Technology Architecture	3
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **Know**—demonstrate appropriate breadth and depth of an enterprise technology stack and the comprehension of its application towards the strategic leverage in an organization.
2. **Apply/Create**—use architecture frameworks and assessment methodologies to apply knowledge, and create new, applicable knowledge supporting advanced, creative accomplishment.
3. **Think**—demonstrate analytical and critical thinking within the enterprise architecture discipline; and, in particular, the ability to improve thinking around the use of strategic use of technology from a business perspective.
4. **Professional Practice**—know and conduct themselves in accordance with the highest ethical standards, values, and, where these are defined, the best practices of their disciplines; and, in particular, the ability to understand the current state of technologies available and know when to leverage their use towards gaining strategic advantage in an organization.

Contact

Campus	World Campus
Graduate Program Head	Carleen Maitland
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Edward J Glantz
Program Contact	Chrissie Fitzgerald College of Information Sciences and Technology E397 Westgate Building University Park PA 16802 cml195@psu.edu (814) 863-9461
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/enterprise-architecture-certificate/overview/)

Enterprise Information and Security Technology Architecture Graduate Credit Certificate Program

Person-in-Charge	Carleen Maitland
Program Code	ENTSEC
Campus(es)	World Campus

The goal of this advanced nine-credit graduate certificate in Enterprise Information and Security Technology Architecture (ENTSEC) is to provide information technology and business professionals with advanced knowledge of the enterprise information technology stack, enterprise architecture gap analysis, analytical risk management, migration planning, governance, and measurement, as well as security and network management strategy including: intrusion detection, encryption, authentication, and network management.

The certificate program is an attractive option for professionals who may also consider completing the M.P.S. in Enterprise Architecture. Up to 15 credits of Penn State course work taken in non-degree status may count towards a graduate degree in EA, but completion of the course work neither implies nor guarantees admission to a graduate degree program at Penn State. Courses taken in the certificate program may be applied toward a graduate degree in Enterprise Architecture, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>). Certificate students who wish to have certificate courses applied towards a graduate degree in Enterprise Architecture must apply and be admitted to that degree program. Admission to the Enterprise Architecture graduate degree program is a separate step and is not guaranteed.

Effective Semester: Fall 2023

Expiration Semester: Fall 2028

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

A bachelor's degree in a related area (e.g., information sciences, engineering, or computer science), while not necessary for admission, is helpful in the successful completion of the certificate. It is expected that students will have advanced knowledge in information technology and enterprise architecture with a minimum of five years of relevant professional work experience. Applicants with less than five years of 2 relevant professional work experience may be considered but will be required to take prerequisite courses. For admission to the certificate, a 2.75 GPA, either overall or from the last 60 undergraduate credits, is needed. GRE scores are not required for non-degree graduate students.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

The certificate is highly flexible and is designed to meet the different needs of students and organizations. The courses are delivered online through the World Campus. With online delivery, the certificate can easily fit into the work schedule of professionals from around the globe.

To be awarded the certificate, students must successfully complete 9 credits of graduate course work with a grade point average of 3.0 or higher.

Code	Title	Credits
Required Courses		
EA 874	Enterprise Information Technology Architecture	3
EA 876	Architecting Enterprise Security and Risk Analysis	3
IST 554	Network Management and Security	3
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **Know**—demonstrate appropriate breadth and depth of an enterprise technology stack and the comprehension of its application towards the strategic leverage in an organization.
2. **Apply/Create**—use architecture frameworks and assessment methodologies to apply knowledge, and create new, applicable knowledge supporting advanced, creative accomplishment.
3. **Think**—demonstrate analytical and critical thinking within the enterprise architecture discipline; and, in particular, the ability to improve thinking around the use of strategic use of technology from a business perspective.

Contact

Campus	World Campus
Graduate Program Head	Carleen Maitland
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Edward J Glantz
Program Contact	Chrissie Fitzgerald College of Information Sciences and Technology E397 Westgate Building University Park PA 16802 cml195@psu.edu (814) 863-9461
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-enterprise-information-and-security-technology-architecture-certificate/overview/)

Entrepreneurship & New Ventures Graduate Credit Certificate Program

Person-in-Charge	Zugang Liu
Program Code	ENTNWV
Campus(es)	Great Valley

This Revised Graduate Certificate in Entrepreneurship & New Ventures is designed specifically for current and aspiring entrepreneurs or intrapreneurs to help students conceptualize and develop new business ventures and/or new products/services to take to market. The program will engage students in a creative process including opportunity recognition, idea generation and selection, the lean start-up process, and business plan development. Using a cross-disciplinary approach, students will gain competence in writing all sections of business plan development. Students will also have an opportunity to pitch their new ventures/products.

Effective Semester: Fall 2022

Expiration Semester: Fall 2027

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

The successful applicant is generally expected to have a minimum combined junior/senior grade-point average of 3.0 (B) on a 4.0 scale.

It is recommended that non-business degree holders take at least one elective course prior to BUSAD 811 and BUSAD 822. Please speak to your advisor before starting certificate.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

To be awarded the graduate certificate, students must successfully complete 9 credits of course work consisting of 6 required credits and 3 elective credits. All courses must be completed with a minimum grade of C or better and an overall GPA of 3.0.

Code	Title	Credits
Required Courses		
BUSAD 811	New Ventures Ideation and Feasibility Analysis	3
BUSAD 822	New Venture Start-up	3
Choose 1 course from the following:		
ACCTG 800	Financial and Managerial Accounting	3
BUSAD/LEAD 519	Developing Creative High Performance Organizations	
BADM 828	Negotiations	
BUSAD 882	Social Entrepreneurship and Community Leadership	
MGMT 507	Positive Organizational Behavior and Wellbeing	
MGMT 823	Organizational Change: Theory and Practice	
MGMT 873	Corporate Innovation Strategies	
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

Students will also have an opportunity to pitch their new ventures/products. Upon completion of certificate, students will be able to:

1. Demonstrate understanding of the new venture process including ideation, feasibility, and plan development.
2. Demonstrate skills required to develop a new venture.
3. Effectively communicate their plan and vision to multiple stakeholders.

Contact

Campus	Great Valley
Graduate Program Head	Zungang Liu

Director of Graduate Studies (DGS) or Professor-in-Charge (PIC) Cynthia D Walton-Bongers

Program Contact

DENISE Y. SMITH
30 East Swedesford Road
Malvern PA 19355
dms7338@psu.edu
(610) 648-3336

Program Website

View (<https://greatvalley.psu.edu/academics/graduate-certificates/new-ventures-and-entrepreneurship/>)

Family Literacy Postbaccalaureate Credit Certificate Program

Person-in-Charge Esther Prins

Program Code FMLTRC

Campus(es) World Campus

The certificate in Family Literacy, based on a multidisciplinary approach to literacy instruction involving both adult educators and early childhood education and family literacy specialists, is intended for location-bound students who work in a variety of literacy-related settings, both formal and informal. These settings include public schools and preschools (teachers, teaching assistants, reading specialists), organizations such as Head Start and grant-funded family literacy programs. The goal of the certificate is to build the capacity of the field to provide high-quality, research-based instruction and program development in family literacy. The certificate consists of a 12-credit program delivered online through the World Campus. The program objectives include strengthening program effectiveness through developing an understanding of staff roles and responsibilities as part of a collaborative family literacy team and supporting a learner-centered approach to delivering program services.

Effective Semester: Spring 2020

Expiration Semester: Spring 2025

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
ADTED 456	Introduction to Family Literacy	3

ADTED 457	Adult Literacy	3
ADTED 458	Early Literacy Development	3
ADTED 459	Interactive Literacy and Parental Involvement: Supporting Academic Success	3
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

- FAMILY CHARACTERISTICS:** Students will understand the qualifying and distinguishing characteristics of families, such as strengths, goals, and needs, for whom family literacy services are designed.
 - PROGRAM CHARAC:** Students will be able to identify key characteristics and quality standards for the four components of family literacy programs: Adult Education (AE), Early Childhood Education (ECE), Parent Education (PE), and Interactive Literacy Activities (ILA).
 - ROLE OF PROF DEV:** Students will understand the role of professional development in family literacy.
 - ROLE OF DIVERSITY:** Students will understand how diversity impacts family needs and delivery of program services.
 - ROLE OF AE:** Students will understand the role of adult education and how it relates to adult learners' needs and their roles as caregivers, workers, and community members.
 - CHILDREN LANG & LIT:** Students will identify key characteristics of children's language and literacy development and how parents can support their children becoming successful readers and writers.
 - PARENT ROLE:** Students will learn how to strengthen and enhance parents' knowledge of their roles and responsibilities as their children's first teachers.
8. **ENGAGE IN ILA:** Students will learn how to engage in interactive literacy activities with children and how to engage with schools and teachers.

Contact

Campus	World Campus
Graduate Program Head	Esther Susana Prins
Program Contact	Elisabeth L. McLean 125 CEDAR Building University Park PA 16802 elg6@psu.edu (814) 863-3777
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/family-literacy-certificate/overview/)

Family/Individual Across the Lifespan Nurse Practitioner Graduate Credit Certificate Program

Person-in-Charge	Judith Hupcey
Program Code	FNP
Campus(es)	World Campus

The purpose of the Family/Individual Across the Lifespan Nurse Practitioner (FNP) certificate is to prepare individuals with a Master's degree or higher in Nursing seeking additional certification as a Family Nurse Practitioner. The curriculum includes the didactic and clinical courses required for application of the NP role and required for certification.

Effective Semester: Fall 2022

Expiration Semester: Fall 2027

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Applicants are required to have a Master's degree in nursing from an ACEN or CCNE accredited institution. In addition, undergraduate chemistry and statistics are required. Students need to submit two recommendations and official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>).

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
NURS 870F	Family Nurse Practitioner Role with Healthy Family/Individual	3
NURS 871F	Family Nurse Practitioner Role with Individuals and Families with Complex and/or Chronic Health Prob	3
NURS 872F	Family/Individual Across the Lifespan Nurse Practitioner Doctoral Practicum I	2
NURS 873F	Family/Individual Across the Lifespan Nurse Practitioner Doctoral Practicum II	3
NURS 874F	Family/Individual Across the Lifespan Nurse Practitioner Integrative Doctoral Practicum	5

NURS 875	Nurse Practitioner Role with Children and Families	2
NURS 876F	Family/Individual Across the Lifespan Nurse Practitioner Doctoral Practicum in Child Health	1
NURS 877F	Clinical Practice Synthesis for Family/Individual Across the Lifespan Nurse Practitioner	3

Additional Course Work May Be Required ¹*Advanced Practice Core*

NURS 802	Advanced Health Assessment of Adult Populations	
NURS 802A	Advanced Health Assessment of Pediatric Populations	
NURS 803	Pathophysiology for the Advanced Practice Nurse	
NURS 804	Pharmacologic Therapy for the Advanced Practice Nurse	

DNP CORE

NURS 510	Theoretical and Scientific Foundations of Advanced Nursing Practice (DNP Core)	
NURS 830	Evidence-Based Practice I: Inquiry and Research Methods	

Total Credits		22
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¹ Any or all of these courses may be waived based on the certificate program chair's evaluation of transcripts and prior courses completed.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Design and evaluate new models of care based on integration of theoretical and empirical knowledge from nursing and related disciplines.
2. Translate evidence to guide practice and improve outcomes of care.
3. Analyze data which predicts and explains variations in practice.
4. Provide inter-professional leadership within an increasingly complex health care delivery system.
5. Prepare leaders to use information systems and technology to support and improve patient care and health care systems.
6. Prepare leaders to direct and deliver high quality, cost-effective care for diverse populations.
7. Shape health policy and systems of health care in the local, regional, state, national, and international forums.
8. Perform independently at the most advanced level of ethical specialty nursing practice.

Professional Licensure/Certification

Many U.S. states and territories require professional licensure/certification to be employed. If you plan to pursue employment in a licensed profession after completing this program, please visit the

Professional Licensure/Certification Disclosures by State (<https://www.psu.edu/state-licensure-disclosures/>) interactive map.

Contact

Campus	University Park
Graduate Program Head	Judith E Hupcey
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Susan Leight
Program Contact	Cassidy Shull 203 Nursing Sciences Building Pennsylvania State University University Park PA 16802 crh5490@psu.edu (814) 865-0368
Program Website	View (http://www.nursing.psu.edu/graduate/certificates/)

Campus	World Campus
Graduate Program Head	Judith E Hupcey
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Susan Leight
Program Contact	Cassidy Shull crh5490@psu.edu (814) 865-0368
Program Website	View (https://www.nursing.psu.edu/graduate-certificates/)

Financial Accounting Graduate Credit Certificate Program

Person-in-Charge	Zugang Liu
Program Code	FINACT
Campus(es)	Great Valley

The Graduate Certificate in Financial Accounting provides the necessary academic preparation for students to pursue further graduate accounting education and prepare for the CPA exam. Topics covered are relevant to CPA licensure and include tax planning, understanding commercial transactions, ethics, accounting information system, government and not-for-profit accounting. All courses in the certificate may be applied to Penn State Great Valley's Master of Professional Accounting degree upon successful completion.

Effective Semester: Fall 2022
Expiration Semester: Fall 2027

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

The successful applicant is generally expected to have a minimum combined junior/senior grade-point average of 3.0 (B) on a 4.0 scale. Student may apply who are not undergraduate accounting degree holders, but foundation coursework will be necessary.

Courses taken in the certificate program may be applied toward Penn State Great Valley's Master of Professional Accounting degree, subject to restrictions outlined in GCAC-309 Transfer Credit. Certificate students who wish to have certificate courses applied towards the Master of Professional Accounting must apply and be admitted to that degree program. Admission to the Master of Professional Accounting graduate degree program is a separate step and is not guaranteed.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

To be awarded the graduate certificate, students must successfully complete 9 credits of course work. All courses must be completed with a minimum grade of C or better and an overall GPA of 3.0.

Code	Title	Credits
Required Courses		
ACCTG 512	Financial Accounting Theory and Reporting Problems	3
ACCTG 873	Advanced Topics in Financial Reporting	3
Choose 1 courses from the following:		
ACCT 532	Accounting Information and Decision Systems	3
ACCT 545	Strategic Cost Management	
ACCTG 462	Governmental and Not-for-Profit Accounting	
ACCTG 804	Data Analytics in the Accounting Profession	
ACCTG 806	Taxes and Business Planning	
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

- Students will be able to identify and explain the application of data mining technologies within organizations.
- Students will analyze and assess basic flaws in accounting systems and internal controls and evaluate actions/decisions in terms of ethical components.
- Students will be able to analyze an organization's financial statements and compare to industry and key competitors.

Contact

Campus	Great Valley
Graduate Program Head	Zugang Liu
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Qiang Qiang
Program Contact	DENISE Y. SMITH 30 E Swedesford Road Malvern PA 19355 dms7338@psu.edu (610) 648-3336
Program Website	View (https://greatvalley.psu.edu/academics/graduate-certificates/financial-accounting/)

Financial Analysis Graduate Credit Certificate Program

Person-in-Charge	Alfred Warner
Program Code	FINANL
Campus(es)	Erie

The Graduate Certificate in Financial Management is designed to enhance essential skills for making intelligent financial business decisions. The required courses for the certificate provide a strong foundation in financial theory, building on the concepts of time value of money and risk management. Students will acquire technical skills for developing analytical approaches and improve critical thinking abilities through hands-on coursework and real-world case studies. Real world examples will be covered in corporate finance, investments, portfolio theory and international analysis are emphasized.

In addition to being an excellent stand-alone credential, all of the courses in the Graduate Certificate in Financial Management can be applied toward the blended M.B.A. program offered through Penn State's Behrend College. However, successful completion of the certificate neither guarantees nor implies acceptance into any graduate program at Penn State. Admission to the M.B.A. graduate degree program is a separate step and is not guaranteed. Approval to apply nondegree graduate credits toward a degree program must be granted by the student's academic adviser, the program head or graduate officer, and the Graduate School. A maximum of 15 credits earned as a nondegree student may be applied to a degree program, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>).

Effective Semester: Fall 2021
Expiration Semester: Fall 2026

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/>).

gcac-300/gcac-305-admission-requirements-international-students/) for more information.

An applicant must demonstrate fundamental competence in Finance either by attaining a B or better in FIN 300, FIN 301, or equivalent or by completing an online training module as designated by the program.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

All candidates are required to take 12 credits in four courses (corporate finance, portfolio management, portfolio analysis, and either undergraduate or graduate level financial statement analysis).

Code	Title	Credits
Required Courses		
ACCTG 426	Financial Statement Analysis	3
or ACCTG 881	Financial Statement Analysis	
BADM 532	Corporate Finance	3
BADM 834	Portfolio Management	3
FIN 420	Investment and Portfolio Analysis	3
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Master the basic tools of financial analysis including assessment of financial statements, valuation for stocks and bonds, capital budgeting, and assessing optimal capital structure.
2. Have a clear understanding and appreciation of a wide variety of risk types including market (systematic) risk, security (diversifiable) risk, psychological risks for investors, and several unique risks for different securities such as fixed-income securities. This class measures risk in terms of standard deviation (and variance) and in terms of beta.
3. Understand and quantify the role of risk management in two key ways. First, students will explore a variety of securities that would allow an investor or firm to hedge different risks and create value with risk management. Second, applied risk management projects ask students to identify firms that could benefit from management strategies.
4. Understand the entire spectrum of derivatives including those based on fixed-income securities, interest rates, foreign exchange, and equities. Master the basic techniques for the valuation of forwards, futures, swaps, and vanilla options (calls and puts).

Contact

Campus	Erie
Graduate Program Head	Al Warner
Program Contact	Lea Saunders l1s5443@psu.edu (814) 898-6716

Financial Analytics Graduate Credit Certificate Program

Person-in-Charge	Zugang Liu
Program Code	FNDFNC
Campus(es)	Great Valley

The Graduate Certificate in Financial Analytics is a program that lays the foundations for those students who aim to pursue a career in corporate finance or as a financial analyst. The topics include: fundamental economics theory, knowledge about various financial instruments, financial planning methods, quantitative analysis tools and software for decision-making, portfolio management, valuation of fixed income securities and financial derivatives, and risk management in the global market. A certificate will be awarded upon completion of the courses. It will prepare the students with the finance skills to face the real-world workplace applications.

Effective Semester: Fall 2023

Expiration Semester: Fall 2028

Admission Requirements

1. Applicants apply for admission to the program via the Graduate School application for admission (<http://gradschool.psu.edu/prospective-students/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions (<http://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information. The successful applicant is generally expected to have a minimum combined junior/senior grade-point average of 3.0 (B) on a 4.0 scale.
2. Courses taken in the certificate program may be applied toward Penn State Great Valley's Master of Finance degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards the Master of Finance must apply and be admitted to that degree program. Admission to the Master of Finance graduate degree program is a separate step and is not guaranteed.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

To be awarded the graduate certificate, students must successfully complete 9 credits of course work consisting of 6 required credits and 3

elective credits. All courses must be completed with a minimum grade of C or better and an overall GPA of 3.0.

Code	Title	Credits
Required Courses		
BA 831	Foundations in Finance	3
BUSAD 525	Quantitative Methods in Finance	3
BADM 834	Portfolio Management	3
or FIN 805	Multinational Managerial Finance	
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. The students will demonstrate enhanced analytical and critical thinking skills.
2. The students will be effective communicators in finance.
3. Students will be able to demonstrate knowledge of global financial markets and their impact.

Contact

Campus	Great Valley
Graduate Program Head	Zugang Liu
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Qiang Qiang
Program Contact	DENISE Y. SMITH dms7338@psu.edu (610) 648-3336

Financial Engineering Graduate Credit Certificate Program

Person-in-Charge	Jessica Zhao
Program Code	FINENG
Campus(es)	Erie World Campus

The Graduate Certificate in Financial Engineering is designed to prepare both current and returning students to apply knowledge of finance, economics, statistics, and data analysis to make sound financial decisions and build an ability to design financial instruments and risk management strategies. The certificate requires a total of 9 credit hours and can be completed concurrently with a Penn State Behrend degree or via continuing education. Students will acquire technical skills for developing analytical approaches and improve critical thinking abilities through hands-on coursework and real-world case studies. Real-world examples will be covered in corporate finance, portfolio theory, and financial derivatives.

Besides being an excellent stand-alone credential, all of the Graduate Certificate in Financial Engineering courses can be applied as Financial Engineering concentration toward the oMBA program offered through Penn State's World Campus.

All of the Graduate Certificate in Financial Engineering courses can be applied toward the blended MBA program offered through Penn State's Behrend Campus. However, successful completion of the certificate neither guarantees nor implies acceptance into any graduate program at Penn State. Admission to the MBA. the graduate degree program is a separate step and is not guaranteed. Approval to apply non-degree graduate credits toward a degree program must be granted by the student's academic adviser, the program head or graduate officer, and the Graduate School. A maximum of 15 credits earned as a non-degree student may be applied to a degree program, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>).

Effective Semester: Spring 2022

Expiration Semester: Spring 2027

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

An applicant must demonstrate fundamental competence in finance either by attaining a B or better in FIN 300, FIN 301, or equivalent or by completing an online training module as designated by the program.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

All candidates are required to take nine credits in three courses (Econometric Analysis, Derivative Securities, and Financial Modeling).

Code	Title	Credits
Required Courses		
MFE 801	Econometric Analysis	3
MFE 527	Derivative Securities	3
MFE 816	Financial Modeling	3
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up

deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Have a clear understanding of the theoretical background and classical assumptions for standard econometric methods, explain their significance, and describe the effects of violations of classical assumptions.
2. Be able to use econometric software to perform an empirical analysis.
3. Be able to examine the essential financial characteristics of derivative securities such as swaps, forward, futures, and options contracts and their roles in managing individual and corporate financial risk, and apply these concepts to integrate a comprehensive risk management approach.
4. Explain the theoretical arbitrage relationships that form the basis for all derivatives pricing.
5. Be able to analyze real-world finance data, apply advanced skills such as Data Analysis tools, Advanced reporting, Monte Carlo simulation, and user-defined functions via spreadsheet and scripting programming language to make financial decisions.

Contact

Campus Erie
Graduate Program Head Xin Jessica Zhao
Program Contact Lea Saunders
 lls5443@psu.edu
 (814) 898-6716

Campus World Campus
Graduate Program Head Xin Jessica Zhao
Program Contact Lea Saunders
 lls5443@psu.edu
 (814) 898-6716

Certificate Program Head: Jessica Zhao
Email: xuz12@psu.edu
Mailing Address: 256 Burke Center, 5101 Jordan Road, Erie PA 16563
Telephone: (814) 898-6256

Folklore and Ethnography Graduate Credit Certificate Program

Person-in-Charge Jeffrey P. Beck
Program Code CLFKET
Campus(es) Harrisburg

This 15-credit graduate certificate program offered at Penn State Harrisburg provides students with skills and practices used in projects and institutions of folklore and ethnography, which include field/folk schools and other educational settings, festivals and arts councils, historical and heritage societies, community and cultural organizations and centers, archives and record management programs, governmental agencies, cultural conservation/sustainability groups, and media production companies.

Students will leave the certificate program with a rich understanding of the way that culture informs our society, politics, individual psychology, and collective memory. But it will balance the development of specialist

knowledge with the cultivation of practical skills for cultural inquiry and documentation. Students will develop their understanding of how to perform ethical and effective qualitative research with human subjects and will have many opportunities to apply these skills in field settings. They will also be offered opportunities to train in public sector work, including museum curation, historic preservation, and public programming.

Effective Semester: Fall 2023

Expiration Semester: Fall 2028

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Applicants are expected to have 3.00 GPA or above in the last two years of undergraduate work in folklore, anthropology, sociology, American Studies, ethnic studies, history, communications, or other fields related to folklore and ethnography. Applicants should submit a 300-500 word statement of interest along with their application to the program.

A student in the certificate program may also become a student in the M.A. and Ph.D. in American Studies, M.A. in Communications, or M.A. in Humanities, if the student meets criteria for admission to the Graduate School and to the graduate program; however, successful completion of the certificate neither implies nor guarantees admission to a graduate program at Penn State. Courses taken in the certificate program may be applied toward a graduate degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards a graduate degree must apply and be admitted to that degree program.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

The Folklore and Ethnography certificate is awarded for successful completion of 9 credits of prescribed courses plus 6 credits of electives from an approved list of courses. Students must earn a grade of B or above in each course that counts toward the certificate program. Substitution of courses related to folklore and ethnography for elective credits is possible with approval in advance from the certificate coordinator.

Code	Title	Credits
Prescribed Courses		
AMST 530	Topics in American Folklore	3
AMST 531	Material Culture and Folklife ¹	3

or AMST 541	Ethnography of Technology and Media in the United States	
AMST 540	Ethnography and Society	3
Electives		
In addition to the 9 credits of prescribed course work, students must select 6 credits from the following list of elective courses:		6
AMST 417	American Beliefs and Myths	
AMST 423	Folk Groups and Genres	
ANTH 448	Ethnography of the United States	
AMST 482	Public Heritage Practices	
AMST 493	The Folktale in American Literature	
AMST 550	Seminar in Public Heritage	
AMST 595	Internship	
or AMST 495	Internship	
ANTH 422	Meso-American Archaeology and Ethnography	
ANTH 445W	Ethnographic Film	
ANTH 453	Anthropology of Religion	
ANTH 457	Jewish Communities: Identity, Survival, and Transformation in Unexpected Places	
ANTH 458	Ethnographic Field Methods	
CI 511	Educational Ethnography: History, Theory, and Methods	
CI 512	Contemporary Educational Ethnography	
CI 513	Video Ethnography in Education	
CMLIT 408	Heroic Literature	
CMLIT 480	The International Folktale	
LLED 563	Myths and Folktales in Children's Literature	
Total Credits		15

¹ Student must choose to complete one of either AMST 531 or AMST 541 (both are not required, though either may be taken as an elective, if not used to complete the prescribed courses requirement).

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Demonstrate knowledge of folklore as a field, including its history, scope, and theories, and ethnography as an important research methodology.
2. Understand and apply methods and techniques applicable to folkloristic and ethnographic field research, such as personal or group interviewing, participant observation, field note taking, audio-video recording, ethnographic data coding, and ethnographic writing.
3. Develop skills for working with folkloristic and ethnographic organizations, such as archival processing; records management; festival and public programming; cultural resource management; oral and written communication; grant-writing; and media design.

Contact

Campus	Harrisburg
Graduate Program Head	Jeffrey P Beck
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Anthony Bak Buccitelli
Program Contact	Amber Reichwein Penn State Harrisburg 777 W Harrisburg Pike 356W Olmsted Middletown PA 17057 anr244@psu.edu (717) 948-6201
Program Website	View (https://harrisburg.psu.edu/humanities/american-studies/graduate-certificate-folklore-and-ethnography/)

Foundations of Artificial Intelligence Graduate Credit Certificate Program

Person-in-Charge	Raghu Sangwan
Program Code	MAIFAI
Campus(es)	Great Valley World Campus

The Foundations of Artificial Intelligence Graduate Certificate prepares students for working as an AI Engineer who will analyze, identify, architect, design, and implement AI systems using various techniques. Students master the following skill set essential to this industry role:

- Identifying AI related problems
- Designing AI-based solutions based on machine learning, computer vision, natural language understanding, search and planning, agent systems, reinforcement, and deep learning techniques
- Identifying ethical concerns
- Specifying accountable AI
- Developing proof of concepts for AI solutions

Courses taken in the certificate program may be applied toward a master's degree in Artificial Intelligence, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards a graduate degree must apply and be admitted to that degree program. Admission to the graduate degree program is a separate step and is not guaranteed.

Effective Semester: Spring 2024

Expiration Semester: Spring 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/>)

gcac-300/gcac-305-admission-requirements-international-students/) for more information.

1. The successful applicant is generally expected to have a minimum combined junior/senior grade-point average of 3.0 (B) on a 4.0 scale.
2. Courses taken in the certificate program may be applied toward Master of Software Engineering degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards the Master of Software Engineering must apply and be admitted to that degree program. Admission to the Master of Software Engineering graduate degree program is a separate step and is not guaranteed.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
A-I 801	Foundation of Artificial Intelligence	3
DAAN 862	Analytics Programming in Python	3
IE 575	Foundations of Predictive Analytics	3
STAT 500	Applied Statistics	3
Total Credits		12

All courses must be completed with a minimum grade of C or better and an overall GPA of 3.0.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **KNOW** - Demonstrate proficiency in identifying disciplines in the AI landscape and mastering foundational concepts in machine learning, intelligent agents, search and planning techniques.
2. **APPLY/CREATE** - Demonstrate mastery of concepts and methods for modeling, designing, developing, and testing data-centric AI systems.

Contact

Campus	Great Valley
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Youakim Badr
Program Contact	Sharon V. Patterson 30 E. Swedesford Rd. Malvern PA 19355 svp40@psu.edu (610) 648-3318
Campus	World Campus
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Youakim Badr
Program Contact	Sharon V. Patterson 30 E. Swedesford Rd. Malvern PA 19355 svp40@psu.edu (610) 648-3318

Foundations of Data Science Graduate Credit Certificate Program

Person-in-Charge	Raghu Sangwan
Program Code	MDAFDS
Campus(es)	Great Valley World Campus

The Graduate Certificate in Foundations of Data Science is a program for students who aim to pursue a career as a Data Scientist or as a Data Analyst and be responsible for creating solutions and strategies for complex problems, applying algorithmic methods to discover patterns in data, create comprehensive analytical solutions for business problems, analyze large amounts of data, create analytics solutions for business problems, and use of data to predict future trends and events. Students develop knowledge and skills relevant to machine learning, deep learning, statistical analysis and computing, and processing large amounts of data. A certificate will be awarded upon completion of the courses.

Courses taken in the certificate program may be applied toward a master's degree in Data Analytics, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards a graduate degree must apply and be admitted to that degree program. Admission to the graduate degree program is a separate step and is not guaranteed.

Effective Semester: Spring 2024
Expiration Semester: Spring 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement;

see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

1. The successful applicant is generally expected to have a minimum combined junior/senior grade-point average of 3.0 (B) on a 4.0 scale.
2. Courses taken in the certificate program may be applied toward Master of Software Engineering degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards the Master of Software Engineering must apply and be admitted to that degree program. Admission to the Master of Software Engineering graduate degree program is a separate step and is not guaranteed.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
DAAN 545	Data Mining	3
IE 575	Foundations of Predictive Analytics	3
STAT 500	Applied Statistics	3
Total Credits		9

All courses must be completed with a minimum grade of C or better and an overall GPA of 3.0.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **KNOW** - learning techniques to formulate and build better predictive analytical systems.
2. **APPLY/CREATE** - introduce the principles of analytical thinking for addressing different aspects of the society.
3. **APPLY/CREATE** - learning techniques to formulate and build better descriptive analytical systems.

Contact

Campus	Great Valley
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Adrian Sorin Barb
Program Contact	Sharon V. Patterson 30 E. Swedesford Rd. Malvern PA 19355 svp40@psu.edu (610) 648-3318
Campus	World Campus
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Adrian Sorin Barb
Program Contact	Sharon V. Patterson 30 E. Swedesford Rd. Malvern PA 19355 svp40@psu.edu (610) 648-3318

Fundamentals of Leadership Graduate Credit Certificate Program

Person-in-Charge	Zugang Liu
Program Code	LDRSHP
Campus(es)	Great Valley

The Graduate Certificate in Fundamentals of Leadership prepares you to craft the building blocks of leadership. You will acquire fundamental knowledge for the character strength-based leadership development, full range leadership development, and the effectiveness of authentic, ethical, and creative leadership. Such knowledge provides a foundation for you to become a transformational leader who cultivates human sustainability and flourishing organizations.

Effective Semester: Fall 2022
Expiration Semester: Fall 2027

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

The successful applicant is generally expected to have a minimum combined junior/senior grade-point average of 3.0 (B) on a 4.0 scale. Acceptance in the Graduate Certificate in Fundamentals of Leadership Certificate program has no GMAT or GRE requirements.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

To be awarded the graduate certificate, students must successfully complete 9 credits of course work consisting of 6 required credits and 3 elective credits. All courses must be completed with a minimum grade of C or better and an overall GPA of 3.0.

Code	Title	Credits
Required Courses		
LEAD 501	Leadership Across the Lifespan	3
LEAD/BUSAD 555	Full Range Leadership Development	3
Choose from one of the following courses:		
MGMT 507	Positive Organizational Behavior and Wellbeing	3
LEAD/BUSAD 556	Diversity Leadership	
LEAD 863	Ethical Dimensions of Leadership	
LEAD/BUSAD 519	Developing Creative High Performance Organizations	

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

Upon completion of the Graduate Certificate in Fundamentals of Leadership Certificate, you will:

- Build effective communication and creativity skills as they relate to authentic transformational leadership concepts and processes.
 - Demonstrate skills required for effective communication and promoting creativity in various leadership contexts.
- Build one's own personal authentic transformational leadership competencies through self-reflection and behavioral display.
 - Prepare a personal leadership development plan incorporating feedback from others, and personal strengths and weaknesses with respect to full range leadership behaviors.
- Foster a commitment to high integrity practices in various leadership contexts.
 - Evaluate and analyze the ethical dimension of decision making.

Contact

Campus	Great Valley
Graduate Program Head	Zugang Liu

Director of Graduate Studies (DGS) or Professor-in-Charge (PIC) Zugang Liu

Program Contact

DENISE Y. SMITH
30 E Swedesford Road
Malvern PA 19355
dms7338@psu.edu
(610) 648-3336

Program Website

View (<https://greatvalley.psu.edu/academics/graduate-certificates/leadership/>)

Geodesign Graduate Credit Certificate Program

Person-in-Charge

Roxi Thoren

Program Code

GEODZ

Campus(es)

World Campus

The purpose of the graduate certificate in Geodesign is to provide students with a foundation in geospatially-oriented design through investigating interdisciplinary methods and the collaborative nature of the Geodesign process. This program is for current or aspiring practitioners, from a variety of professional backgrounds, employed in government agencies, businesses, and non-profit organizations, who see limitations in how regional and urban planning and design challenges are currently addressed. The program is designed for professional practitioners who wish to advance their careers, and for those seeking to make career changes, while remaining in their current location or maintaining full-time professional responsibilities.

Effective Semester: Fall 2023

Expiration Semester: Fall 2028

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

The certificate consists of a five-course, 15-credit curriculum that can be completed in one year and is delivered online through the World Campus. Students must earn a "C" or better in each course that is intended to count toward the certificate.

Code	Title	Credits
Required Courses		
GEODZ 511	Geodesign History, Theory, Principles	3

GEOEZ 822	GeoDesign Models I: Evaluation and Decision	3
GEOEZ 824	GeoDesign Models II: Process and Impact ¹	3
or GEOEZ 826	GeoDesign Models III: Representation and Change	

Electives

In addition to the 9 required credits specified above, students must select at least 6 credits of GEOG courses at the 400 level or higher; courses must be approved in advance by the student's adviser. A list of acceptable electives is maintained by the program office.

Total Credits 15

¹ Students will take one of these two "Models" courses; placement is dependent on previous experience.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Discern the core principles of historic and contemporary foundations of geodesign theory.
2. Identify cumulative affects of changes in population, climate, and biodiversity, and their impacts to food and water to understand how to influence major environmental and social change.
3. Comprehend the definition of geographic space in its broadest context, including temporal, cultural, economic and other social and environmental systems – essentially nD thinking.
4. Demonstrate knowledge of the multidimensional scope and scale of projects to which geodesign can be applied.
5. Appreciate the importance of balancing the creative and scientific processes and their influence on geodesign solutions.
6. Ascertain the appropriate application of key design methodologies specific to geospatial issues, such as systems thinking, and design as an operations/resources problem.
7. Assess how to balance instant feedback with sound decision–# support tools to effectively incorporate myriad data in combination with user needs and preferences.
8. Combine design – the proposed changes to a place – with relevant science–#based and value–#based information, in a manner that explores alternative solutions from a cross–#disciplinary, decision–# driven approach.
9. Critically develop and apply ethical frameworks to appropriately evaluate culturally, socially and economically diverse environments.
10. Develop a collective understanding of other disciplines, the multidisciplinary geodesign process, and how different specialists engage and intersect with one another.
11. Demonstrate proficiency in collaboration tools for team communication, efficient document sharing, topological diagramming, time/dynamics management, and media archiving.
12. Integrate contextual data, objects, and media to represent and discover relationships and constraints of a study area.

13. Apply a working knowledge of geospatial modeling tools that assess, visualize, and compare social, economic, and environmental consequences of design configurations over time.

Contact

Campus	World Campus
Graduate Program Head	Roxi Thoren
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Stuart Patton Echols
Program Contact	David Eric Goldberg Geodesign Program Office 121 Stuckeman Family Building University Park PA 16802 deg112@psu.edu (814) 865-4148
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/geodesign-certificate/overview/)

Geographic Information Systems Postbaccalaureate Credit Certificate Program

Graduate Program Head	Anthony C. Robinson
Program Code	GISC
Campus(es)	World Campus

The Postbaccalaureate Certificate Program in Geographic Information Systems (GIS) helps professionals in a variety of fields become knowledgeable and skillful users of geographic information systems. The program was designed specifically for experienced GIS practitioners who lack formal education in geography and GIS and wish to advance their careers, and for those who seek to make career changes. The program is offered through Penn State World Campus.

Students subsequently admitted to the Department of Geography Master of Geographic Information Systems degree program may count up to 15 credits of certificate program courses toward the M.G.I.S. degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>). Certificate students who wish to have certificate courses applied towards a graduate degree in Geographic Information Systems must apply and be admitted to that degree program. Admission to the Geographic Information Systems graduate degree program is a separate step and is not guaranteed.

Effective Semester: Spring 2022
Expiration Semester: Spring 2027

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/>)

gcac-300/gcac-305-admission-requirements-international-students/) for more information.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Students earn the Postbaccalaureate Certificate by completing four instructor-led online courses – three required and one elective. Students who successfully complete the program earn 12 academic credits.

Code	Title	Credits
Prescribed Courses		
GEOG 482	Making Maps That Matter With GIS	3
GEOG 483	Problem-Solving with GIS	3
GEOG 484	GIS Database Development	3
Electives		
Select one of the following:		3
GEOG 485	GIS Programming and Software Development	
GEOG 486	Cartography and Visualization	
GEOG 487	Environmental Challenges in Spatial Data Science	
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

- Develop the technical and analytical competencies required to serve as leaders within private and public geospatial technology enterprises.
- Demonstrate effective design, management, and application of geographic information technologies to support complex problems solving.
- Combine prior knowledge and career experiences with technical competencies to become broadly-equipped geospatial technology practitioners.

Contact

Campus	World Campus
Graduate Program Head	Anthony C Robinson
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Anthony C Robinson
Program Contact	Julene A Santiago 418 Earth Engr Sciences University Park PA 16802 jas9616@psu.edu (814) 865-2557
Program Website	View (https://gis.education.psu.edu/cpgis/)

Geospatial Intelligence Analytics Graduate Credit Certificate Program

Person-in-Charge	Greg Thomas
Program Code	GEOINT
Campus(es)	World Campus

The graduate credit certificate in Geospatial Intelligence Analytics is for aspiring geospatial intelligence professionals as well as those with experience in the field who are only able to participate part-time and at a distance, while maintaining professional responsibilities. Students can take foundational or advanced courses depending on their level of expertise. The program promotes sound theory, methodologies, techniques, ethics, and best practices in the professional application of geospatial intelligence. The 15-credit curriculum integrates the geospatial information science and intelligence disciplines in a synergistic manner. The program is well suited for the geospatial intelligence professional serving outside the continental U.S.

Effective Semester: Fall 2023

Expiration Semester: Fall 2028

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
GEOG 571	Intelligence Analysis, Cultural Geography, and Homeland Security	3
or GEOG 882	Geographic Foundations of Geospatial Intelligence	
GEOG 884	Spatial Data Science and Intelligence Analysis	3
or GEOG 483	Problem-Solving with GIS	
GEOG 883	Remote Sensing Image Analysis and Applications	3
or GEOG 479	Spatial Data Science for Cyber and Human Social Networks	
or GEOG 480	Exploring Imagery and Elevation Data in GIS Applications	
GEOG 885	Analytical Methods and GeoAI in Geospatial Intelligence	3
GEOG 594A	Culminating Experiences in Geospatial Intelligence	3
or GEOG 596	Individual Studies	
Total Credits		15

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

- Combine advanced geospatial information science & technology knowledge and cognitive processes including theories, methodologies, techniques, ethics, and best practices to resolve complicated situations.
- Integrate professional experience, science, analytics, and the intelligence disciplines to create effective solutions.

Contact

Campus	World Campus
Graduate Program Head	Gregory A Thomas
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Anthony C Robinson
Program Contact	Julene A Santiago 418 Earth Engr Sciences University Park PA 16802 jas9616@psu.edu (814) 865-2557
Program Website	View (https://gis.education.psu.edu/geointel/)

Geospatial Programming and Web Map Development Graduate Credit Certificate Program

Graduate Program Head	Anthony C. Robinson
Program Code	GEOWBD
Campus(es)	University Park World Campus

The Graduate Certificate in Geospatial Programming and Web Map Development helps geospatial professionals become skillful developers of software for the GIS and mapping industries. These skills include the ability to script the automation of geospatial business processes, to develop custom user interface tools on top of existing desktop applications, and to author web-based mapping applications that support the exploration and analysis of geospatial datasets. Such skills are in high demand in the geospatial industry. This program is designed specifically for geospatial practitioners who seek formal education in geospatial programming and web mapping for the purposes of advancing their professional development or seeking a career change. It covers software development in the uniquely geospatial context using a mixture of proprietary and open source languages and technologies. The core learning objectives for students in this program are:

- Apply contemporary programming principles to automate geospatial analysis and mapping processes.
- Design and implement custom user interfaces to support mapping and spatial analysis.
- Create interactive web-based mapping applications that support spatial data exploration and analysis.

The certificate is offered online through Penn State's World Campus, and students earn the certificate by completing three prescribed courses and two elective courses. Students who successfully complete the program earn 15 academic credits. Students admitted to the Department of Geography's Master of GIS degree program may count up to 15 credits of certificate program courses toward the M.G.I.S. degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>). Certificate students who wish to have certificate courses applied towards a graduate degree must apply and be admitted to that degree program. Admission to a graduate degree program is a separate step and is not guaranteed.

Effective Semester: Summer 2023
Expiration Semester: Summer 2028

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Intermediate-level experience with professional applications of geographic information systems is expected as pre-requisite knowledge. Course work to establish that pre-requisite knowledge is available through the related Postbaccalaureate Certificate in GIS (<http://bulletins.psu.edu/graduate/programs/certificates/geographic-information-systems-postbaccalaureate-credit-certificate-program/>) program.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
GEOG 485	GIS Programming and Software Development	3
GEOG 863	Web Application Development for the Geospatial Professional	3
GEOG 585	Open Web Mapping	3
Electives		
Choose 6 credits from:		6
GEOG 486	Cartography and Visualization	
GEOG 489	Advanced Python Programming for GIS	
GEOG 868	Spatial Database Management for the Geospatial Professional	
GEOG 865	Cloud and Server GIS	
Total Credits		15

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Application - Apply contemporary programming principles to automate geospatial analysis and mapping processes.
2. Communication - Communicate the nuances of complex spatial relationships with text, voice, and visual products to broadly inform professional and non-technical audiences in a range of contexts.
3. Creation - Create interactive web-based mapping applications that support spatial data exploration and analysis.
4. Critical Thinking - Objectively analyze and evaluate a situation in the context of available geospatial programming techniques and technologies in support of problem solving and decision making.
5. Cultural Competence - Demonstrate knowledge of cultural norms that are respectful of diversity and inclusion to establish a positive and professional work environment.
6. Ethics - Demonstrate ethical conduct by producing quality work, contributing to the community, managing professional relationships by establishing honest and respectful interactions among individuals and organizations.

7. Knowledge - Apply knowledge of programming technologies to design and implement custom user interfaces in support of mapping and spatial analysis to educate, solve problems and make decisions.
8. Professional - Demonstrate conduct in alignment with professional standards in interpersonal communication, mediation, and respect for diversity while recognizing appropriate team roles in professional, community and education-based activities.
9. Research - Combine accepted programming techniques and geospatial technologies to create new solutions for previously unencountered situations.

Contact

Campus	University Park
Graduate Program Head	Anthony C Robinson
Program Contact	Julene A Santiago jas9616@psu.edu (814) 865-2557
Campus	World Campus
Graduate Program Head	Anthony C Robinson
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Anthony C Robinson
Program Contact	Julene A Santiago jas9616@psu.edu (814) 865-2557

Global Health Graduate Credit Certificate Program

Person-in-Charge	Cheryl Thompson
Program Code	GLBHL
Campus(es)	Hershey

The purpose of this 12-credit graduate certificate in Global Health is to provide students with foundational graduate-level course work in global health. All course work will be at the 500 or 800 level. Upon completion of the Public Health certificate, students will be able to:

1. Demonstrate their knowledge of the major players and issues in global health, how global health systems interact, and the social, political, and cultural determinants related to health and health systems.
2. Apply their skills to assessing global health issues and developing solutions.

Certificate course work may be transferable to the Penn State Master of Public (M.P.H.) graduate degree program subject to restrictions outlined in GCAC-309 Transfer Credit, (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>) should a student wish to continue public health training at the graduate level. Students must earn a grade of B or better for a course to be applied to the M.P.H. degree program. Students who wish to pursue the M.P.H. degree must formally apply and be admitted to the Penn State M.P.H. degree program. Admission into the Penn State M.P.H. degree program is a separate step and is not guaranteed. Admission into the M.P.H. program, and credit towards a graduate degree for specific courses is not guaranteed based on acceptance into or completion of the certificate program.

Effective Semester: Summer 2023

Expiration Semester: Summer 2028

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Applicants must submit the following items with their application for admission to the Public Health certificate program:

- official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>)
- Resume/CV
- Statement of Purpose or Rationale for seeking a Graduate Certificate in Global Health
- Two letters of recommendation

Admission decisions are made by a faculty committee and are based on the quality of the applicant's professional and academic accomplishments. Upon approval, certificate program students will enroll in course work on a nondegree basis. Note that admission as a nondegree graduate student neither guarantees nor implies subsequent admission to a degree program. Nondegree students are not eligible to receive fellowships or graduate assistantships.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Students must complete each course with a grade of B or better in order to receive the certificate.

Code	Title	Credits
Required Courses		
PHS 803	Principles of Global Health	3
PHS 809	Principles of Public Health ¹	3
or PHS 577	Integrative Seminar in Social & Behavioral Determinants of Health	
Select 6 credits from the following:		6
HLHED 501	World Health Promotion	
HLHED 553	Multicultural Health Issues	
PHS 551	Advanced Epidemiological Methods ²	
PHS 557	Global Impact of Infectious Diseases	
PHS 804	Integrating Systems Thinking in Global Health	
PHS 890	Colloquium	
PHS 895A	Master of Public Health Internship	
PHS 895B	Advanced Field Experience	
PHS 895C	MPH Global Health Internship	

PHS 895D	Dr.P.H. Global Advanced Field Experience
Total Credits	12

¹ Dr.P.H. students take PHS 577.

² Epidemiology and Biostatistics Track students only.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes.

1. Propose evidence based solutions to global health problems.
2. Employ critical thinking and appraisal of the literature to explain the global influences on determinants of health.
3. Apply social justice and human rights principles in public health policies and programs.
4. Describe the roles and relationships of the entities influencing global health.
5. Identify the relationships among patterns of morbidity, mortality, and disability with demographic and other factors in shaping the circumstances of the population of a specified community, country, or region.

Contact

Campus	Hershey Med Ctr
Graduate Program Head	Cheryl Thompson
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Kristin Elizabeth King Sznajder
Program Contact	Shannon Tuininga smb611@psu.edu (717) 531-0003 Ext. 281150
Program Website	View (http://med.psu.edu/global-health-certificate/)

Global Justice and Security Graduate Credit Certificate Program

Person-in-Charge	Ahmet Guler
Program Code	GLJSSC
Campus(es)	World Campus

This certificate program aims to study current global justice and security issues as well as international efforts to combat global crime. Global criminal activities have increased to unprecedented levels in the last three decades and transnational organized crime groups have reaped the advantages of being able to operate and carry out their illicit activities beyond national borders. International security organizations and national criminal justice agencies have also intensified their collaborative and cooperative efforts in fighting against transnational criminal activities in the world. Designed mainly for working professionals, this certificate is ideal for both domestic and international criminal justice practitioners who desire to expand their knowledge and skills

in global justice and security issues and wish to advance their careers in international security organizations. Moreover, individuals planning to work in a broad range of international security-related careers may enroll in this certificate program to increase their chances to work in international organizations.

Effective Semester: Fall 2021

Expiration Semester: Summer 2026

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
CJPA 830	Global Policing	3
CJPA 831	Transnational Crime	3
CJPA 832	Policing Terrorism	3
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Students will be able to explain the push and pull factors of global criminal activities.
2. Students will be able to identify international crime control strategies.
3. Students will be able to analyze global crime trends and evaluate responses to global crime.
4. Students will be able to examine contemporary policing strategies against global terrorism.
5. Students will be able to offer alternative policing approaches to combat global crime.

Contact

Campus	World Campus
Graduate Program Head	Ahmet Guler
Program Contact	Ahmet Guler axg1373@psu.edu (814) 865-2527

Global Management Graduate Credit Certificate Program

Person-in-Charge	Zugang Liu
Program Code	GLBMGT_GCT
Campus(es)	Great Valley

The Graduate Certificate in Global Management is a program for students who aim to pursue a career that includes international business interests and global management competencies. Students develop knowledge and skills relevant to developing and evaluating global and international management strategies and approaches to managing diversity, communicating across cultural contexts, evaluating international business objectives, making multinational managerial finance decisions, and comparing sustainable business practices, innovation, and the design of work in different economies. A certificate will be awarded upon completion of the courses.

Effective Semester: Fall 2023

Expiration Semester: Fall 2028

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

1. The successful applicant is generally expected to have a minimum combined junior/senior grade-point average of 3.0 (B) on a 4.0 scale.
2. Courses taken in the certificate program may be applied toward Penn State Great Valley's Master of Business Administration degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards the Master of Business Administration must apply and be admitted to that degree program. Admission to the Master of Business Administration graduate degree program is a separate step and is not guaranteed.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

To be awarded the graduate certificate, students must successfully complete 9 credits of course work. All courses must be completed with a minimum grade of C or better and an overall GPA of 3.0.

Code	Title	Credits
Required Courses		
Select 3 of the following courses:		9
BUSAD 542	Global Intercultural Management	
FIN 805	Multinational Managerial Finance	
IB 800	International Business Management	
BA 836	Global Immersion	
LEAD 561	Dynamic Communication in Leadership Contexts	
BUSAD/LEAD 556	Diversity Leadership	
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Critical Thinking - The students will demonstrate critical thinking skills in analyzing and describing cultural dimensions relevant to managing and working across cultural boundaries.
2. Global/Knowledge - Students will be able to demonstrate knowledge of global financial markets and their impact.
3. Cultural Competence Skills - Students will develop and implement a personal diversity leadership improvement plan to build expertise in relating with diverse individuals in the workplace.

Healthcare Supply Chain and Operations Management Graduate Credit Certificate Program

Person-in-Charge	Dinesh R. Pai
Program Code	HSCOM
Campus(es)	Harrisburg

The complexity of healthcare delivery systems – varying levels of care, technological and regulatory changes, focus on preventative care, special projects, teamwork, and more – demands effective organizational operations. The goal of this 12-credit certificate program is to better prepare healthcare professionals with those contemporary skills and concepts necessary for the effective and efficient management of the healthcare operations while delivering high-quality, appropriate care. Students will learn to analyze, develop, and implement those functions related to producing and delivering services, managing projects, reducing waste, improving process, and sourcing materials in a healthcare setting.

Effective Semester: Spring 2022
Expiration Semester: Spring 2027

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

This curriculum is designed for working healthcare professionals. Successful applicants will normally have, before the start of their first semester, at least two years' post baccalaureate work experience in healthcare management, healthcare operations, supply chain management, or a closely allied field.

The applicant's baccalaureate degree should be in business, engineering, economics, information sciences, or a related field and the applicant should have completed a college-level course in microeconomic principles with a course in supply chain management and/or operations management strongly recommended. A minimum undergraduate GPA of 2.8 is required unless the student has earned a graduate degree from an accredited university.

Ideally, the applicant should have a working knowledge of Microsoft Excel and business statistics, plus a basic understanding of accounting principles.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
MNGMT 522	Operations and Supply Chain Management	3
HADM 539	Health Systems Organization	3
Electives		
Select one of the following:		3
HADM 545	Health Financial Management	
HADM 541	Health Economics and Policy	
Select one of the following:		3
BUS 510	Business Analytics and Decision Modeling	
MANGT 510	Project Management	
SCIS 546	Procurement and Supply Management	
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up

deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Explain the importance of operations and supply chain management and its role in a healthcare organization's productivity and strategy.
2. Develop and apply tools to manage projects, improve processes, strategic sourcing, and inventory management.
3. Discuss public policy issues, technology, innovations, health system components, health care regulation.
4. Apply theory and techniques of financial management such as working capital, capital budgeting, and institutional financing to health organizations.
5. Apply analytics tools to drive data driven decisions.

Contact

Campus	Harrisburg
Graduate Program Head	Dinesh Ramdas Pai
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Dinesh Ramdas Pai
Program Contact	Amy J Atkins akj11@psu.edu (717) 948-6142

Heritage and Museum Practice Graduate Credit Certificate Program

Person-in-Charge	Jeffrey P. Beck
Program Code	CLHMP
Campus(es)	Harrisburg

This 15-credit graduate certificate program offered at Penn State Harrisburg provides students with knowledge of practices in the heritage and museum sector, which includes historical and heritage societies, public folk arts and folklife centers and programs, art galleries, archives and record management programs, educational institutions, cultural and governmental agencies, preservation and cultural resource management groups, and media production companies. A goal of the program is to enable students to conceptualize, deliver, and manage effective heritage and museum projects.

Effective Semester: Fall 2022
Expiration Semester: Spring 2027

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Applicants are expected to have 2.75 GPA or above in the last two years of undergraduate work in American Studies, history, art, architecture,

anthropology, folklore, management, communications, or fields related to museum and heritage practice.

A student in the certificate program may also become a student in the Master of Arts in American Studies, Master of Arts in Humanities, or Master of Arts in Public Administration degree programs if the student is admitted to one of these graduate degree programs; however, successful completion of the certificate program neither implies nor guarantees admission to any graduate degree program at Penn State. Certificate program students who wish to have the certificate courses applied to a degree program must formally apply and be admitted to that degree program. Students enrolled in any of these degree programs may apply credits earned toward the certificate as elective credits with program approval, subject to restrictions outlined in GCAC-309 Transfer Credit. (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>)

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

The Heritage and Museum Practice certificate is awarded for successful completion of 9 credits of prescribed courses plus 6 credits of electives from an approved list of courses. Students must earn a grade of B or above in each course that counts toward the certificate program.

Code	Title	Credits
Required Courses		
AMST 480	Museum Studies	3
AMST 481	Historic Preservation	3
or AMST 482	Public Heritage Practices	
AMST 550	Seminar in Public Heritage	3
Electives		
Students must select 6 credits from the following list of 500-level elective courses:		6
AMST 520	Topics in Popular Culture	
AMST 530	Topics in American Folklore	
AMST 531	Material Culture and Folklife	
AMST 540	Ethnography and Society	
AMST 551	Seminar in Local and Regional Studies	
AMST 570	Topics in American Art	
AMST 575	Museum Internship	
AMST 595	Internship	
PADM 505	Human Resources in the Public and Nonprofit Sectors	
PADM 516	Strategic Planning	
PADM 517	Nonprofit Organizations: History and Evolution	
PADM 518	Nonprofit Organizations: Management and Leadership	
PADM 519	Nonprofit Organizations: Resource Development and Management	
PADM 800	Foundations of Public Administration	
Total Credits		15

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Gain knowledge of heritage and museum studies field as it has developed in the United States.
2. Provide skills applicable to the heritage and museum studies work, such as exhibition installation, conservation techniques, oral presentation, writing, and media design.
3. Provide opportunities for hands-on experience in heritage and museum practices such as museum exhibition, administration, and education; festival and public programming; visitor services and cultural tourism management.

Contact

Campus	Harrisburg
Graduate Program Head	Jeffrey P Beck
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Mariah Kupfner
Program Contact	Amber Reichwein School of Humanities 777 West Harrisburg Pike, 356W Olmsted Bldg. Middletown PA 17057 anr244@psu.edu (717) 948-6201
Program Website	View (https://harrisburg.psu.edu/humanities/heritage-and-museum-practice-grad-cert/)

Homeland Security Graduate Credit Certificate Program

Person-in-Charge	L. Marvin Overby
Program Code	CLHLS
Campus(es)	World Campus

In this 12-credit graduate certificate program, students will learn about the origins and organization of the Homeland Security Enterprise, including relevant Congressional acts, Presidential policies, and national strategies, as well as the roles and shared responsibility of key agencies and partners at federal, state, and local levels, and from the private sector. They will apply that knowledge to current situations and select scenarios based on an all-hazards and whole-community approach to homeland security and emergency management.

Courses taken in the certificate program may be applied toward a graduate degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards a graduate degree must apply

and be admitted to that degree program. Admission to the graduate degree program is a separate step and is not guaranteed.

The certificate program offers a viable opportunity for those who seek advanced education but do not wish or have not yet determined if they are ready to pursue a full master's degree program. For students in the Intercollege Master of Professional Studies in Homeland Security (iMPSHLS), this program may be pursued to earn an embedded certificate as an additional credential.

Effective Semester: Spring Semester 2021

Expiration Semester: Spring Semester 2026

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Applicants are expected to have a 3.0 or higher GPA in their undergraduate work.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

The curriculum consists of two required courses (6 credits) and two electives (6 credits). Students must achieve a GPA of 3.00 or above to be awarded the certificate.

Code	Title	Credits
Required Courses		
HLS 811	Fundamentals of Homeland Security and Emergency Management	3
HLS 812	Homeland Security and Homeland Defense in Practice	3
Electives		
Choose 6 credits from the following (you may only choose one MBADM course):		6
HLS 475	Critical Infrastructure Protection	
HLS 540	Comparative Homeland Security and Related Methods	
HLS 558	Whole-Community Disaster Preparedness	
HLS 804	Strategic Planning and Organizational Imperatives in Homeland Defense and Security	
HLS 813	Multifaceted Approaches to Homeland Security	
HLS 820	Emerging Threats to Homeland Security	
HLS 821	Transnational Criminal Organizations and HLS	
HLS 832	U.S. Military's Domestic Imperative: Homeland Defense and Defense Support of Civil Authorities	

HLS 875 U.S. Homeland Security Law

In addition, students may choose one of the following courses as an elective:

MBADM 571 Global Strategic Management
or MBADM 8 Managing and Leading People in Organizations

Total Credits 12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **Explain** the origins and organization of the Homeland Security Enterprise.
2. **Describe** how relevant Congressional acts, Presidential directives, and national strategies influence decision making in homeland security.
3. **Identify** the roles and shared responsibility of key agencies and partners at federal, state, and local levels, and of the private sector.
4. **Assess** current situations and select scenarios.
5. **Evaluate** the all-hazards and the whole-community approach to national preparedness and emergency management.

Contact

Campus	World Campus
Graduate Program Head	L. Marvin Overby
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Emma Jane Leonard
Program Contact	Melissa D Forkey 777 West Harrisburg Pike 160W Olmsted Bldg. Middletown PA 17057 mpf5451@psu.edu (717) 948-6322
Program Website	View (https://www.worldcampus.psu.edu/homeland-security-ccn/)

Hospital and Health System Preparedness Graduate Credit Certificate Program

Person-in-Charge	Eugene J. Lengerich
Program Code	HHSP
Campus(es)	World Campus

The Graduate Certificate in Hospital and Health System Preparedness provides students with knowledge and skills to protect the critical infrastructure of hospitals, medical facilities, and emergency management systems. The effective protection of critical infrastructure will allow medical facilities and emergency management systems to remain functional in the midst of natural disasters and intentional and

unintentional incidents. The curriculum will emphasize a systems-based and an all-hazards approach to preparedness. Graduates will be experienced in development and revision of an emergency operations plan, both at facility- and community-level, and exercises to test and evaluate the plan. Graduates will be expected to understand and use an evidence-based approach in designing emergency operations plans and procedures. Graduates are employed by public health, hospitals and healthcare facilities, military and law enforcement, and emergency management services. The certificate is intended for students who seek to further their career in:

- Facility management and services
- Healthcare administration and management
- Emergency management and services
- Infection and quality control

Effective Semester: Summer 2019

Expiration Semester: Summer 2024

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Applicants are required to submit a resume, statement of purpose, 3 letters of recommendation and GRE scores. Applicants may request a waiver from the GRE requirement if they meet one of the following criteria:

- 3.00 undergraduate grade-point average (GPA) either overall or in the last 60 credits;
- 5+ years of professional work experience;
- 3.00 GPA upon completion of a graduate certificate; or
- successful completion of a graduate or professional degree.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

This 15-credit graduate certificate requires the following courses:

Code	Title	Credits
Required Courses		
PHP 410	Public Health Preparedness for Disaster and Terrorist Emergencies I	3
PHP 510	Public Health Preparedness for Disaster and Terrorist Emergencies II	3
PHP 530		
PHP 831	Public Health Preparedness and the Emergency Operations Plan	3

PHP 832	Fundamentals of Biorisk Management	3
or PHP 527	Public Health Evaluation of Disasters and Bioterrorism	

Total Credits 12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. PHP ORG: Students will be able to identify major organizations, agencies, and policies that substantially affect the practice of public health preparedness.
2. PHP APP: Students will be able to identify, design, implement, and evaluate evidence-based approaches to public health preparedness.
3. PHP EPI: Students will be able to apply basic epidemiologic principles and methods to public health preparedness.
4. PHP HOSP ERP: Students will be able identify and evaluate hospital vulnerabilities and to develop a hospital emergency response plan.
5. PHP EXER: Students will be able to plan, implement and evaluate exercises for public health preparedness.
6. PHP BIORISK: Students will be able to identify laboratory biorisks and develop and evaluate biorisk security procedures and protocols.
7. PHP LEAD: Students will demonstrate effective leadership and team-based practices and procedures.

Contact

Campus	World Campus
Graduate Program Head	Eugene Joseph Lengerich
Program Contact	Rachel Marie Reager 500 University Dr., MC H170; Room C1712 Hershey PA 17033 rmr16@psu.edu (717) 531-8892
Program Website	View (https://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-hospital-preparedness-certificate/overview/)

Hospitality Management Graduate Credit Certificate Program

Person-in-Charge	Donna Quadri-Felitti
Program Code	HM_GCT
Campus(es)	University Park

The graduate certificate in Hospitality Management enabled business professionals to acquire new skills to meet the demands of the rapidly changing global hospitality industry. The certificate provides a comprehensive overview of the hospitality industry, helps students

to incorporate data analytics in their decision-making processes and provides students with skills to conduct applies research.

Credits earned in the Hospitality Management certificate apply to the Master of Professional Studies (MPS) in Hospitality Management.

Admission Requirements

Applicants apply for admission to the program via the Graduate School Application for Admission (GRADS) (<https://gradschool.psu.edu/graduate-program-resources/grads-information/grads-access/>). Requirements listed here are in addition to the Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>). Additional admissions requirements include two letters of recommendation and a resume.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
HM 800	Dimensions and Directions of the Hospitality Industry (Executive In-Resident Weekend at University Park) ¹	3
HM 560	Hospitality Data Analytics ²	3
HM 550	Hospitality Applied Research and Consulting ³	3
Total Credits		9

¹ A comprehensive overview of the hospitality industry including foundational aspects that HM master candidates will use throughout their coursework. The content will include an overview of the various segments of the industry and the current events and future trends that will impact those segments.

² This course is for both aspiring and established leaders in the hospitality industry. It offers a cross-disciplinary curriculum taught by area experts and aims at helping students analyze, understand, translate, and incorporate data in their decision-making processes when designing and executing data-driven competitive strategies.

³ This course addresses the methods and skills necessary to conduct applied research: developing research questions determining a research design, identifying appropriate research methodologies, collecting and analyzing data, and providing solutions.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up

deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **KNOW:** Graduates will master advanced knowledge of the global hospitality industry and can distinguish the unique factors characterizing hospitality businesses as compared to businesses in other industries.
2. **APPLY / CREATE:** Graduates will be able to apply data analytics and related research skills to solve problems facing the various segments of the hospitality industry.
3. **COMMUNICATE:** Graduates will display outstanding communication skills.
4. **THINK:** Graduates will demonstrate the ability to think critically about current and future challenges in hospitality management.
5. **PROFESSIONAL PRACTICE:** Graduates will be able to conduct themselves in accordance with the highest ethical standards and be able to demonstrate the relevance of advanced hospitality education to any managerial environment.

Contact

Campus	University Park
Graduate Program Head	Donna L Quadri-Felitti
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Anna S Mattila
Program Contact	Amina Atkins ava6807@psu.edu (814) 863-1448

Human Resource Management Graduate Credit Certificate Program

Person-in-Charge	Zugang Liu
Program Code	HRMT
Campus(es)	Great Valley

The Graduate Certificate in Human Resource Management prepares students to integrate human resource (HR) strategies and practices with organizational strategies in order to improve business performance and employee relations.

Students apply fundamental considerations for managing people in organizations, including workforce planning, forecasting, & adjustment; ethics, diversity, & employment law; talent recruitment, selection, training, development, & performance management; compensation strategy & incentives; HR risk management and employee relations. Students develop knowledge for global and intercultural effectiveness, ethical leadership of strategic change, and specialized competencies for analyzing and managing the talent that drives organizational innovation and sustainability.

Students apply fundamental considerations for managing people in organizations, including workforce planning, forecasting, and adjustment; ethics, diversity & employment law; talent recruitment, selection, training, development, and performance management; compensation strategy & incentives; HR risk management, employee relations and career management. Students develop knowledge for leading strategic change, global and intercultural effectiveness, and specialized competencies for

analyzing and ethically managing the talent that drives organizational innovation and sustainability.

Effective Semester: Fall 2022

Expiration Semester: Fall 2027

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

The successful applicant is generally expected to have a minimum combined junior/senior grade-point average of 3.0 (B) on a 4.0 scale.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

To be awarded the Graduate Certificate in Human Resource Management, students must successfully complete 12 credits of course work. All courses must be completed with a grade of C or better and a grade-point average of 3.0 to be awarded the certificate.

Code	Title	Credits
Required Course		
MGMT 841	Human Resource Management	3
Electives		
<i>Strategic and Ethical Leadership (choose 1):</i>		3
BUS 515	Business Ethics and Corporate Governance	
LEAD 863	Ethical Dimensions of Leadership	
MBADM 815	Ethical and Responsible Business Leadership	
<i>Global & Intercultural Effectiveness (choose 1):</i>		3
BUSAD 542	Global Intercultural Management	
BUSAD/LEAD 556	Diversity Leadership	
HRER 803	Human Resources in Multinational Enterprises	
IB 800	International Business Management	
MNGMT 515	Labor Management Relations	
<i>Specialized Competencies for Managing Human Resources (choose 1):</i>		3
BADM 828	Negotiations	
BUSAD 859	Career Management	
HRER 501	Labor and Employment Law	
MGMT 823	Organizational Change: Theory and Practice	
MGMT 873	Corporate Innovation Strategies	
MNGMT 520	Organizational Transformation	
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Demonstrate appropriate depth and breadth of disciplinary knowledge of key processes, responsibilities, and concerns of Human Resource Management in U.S. and global organizations.
2. Critically analyze current issues associated with managing human capital and employee relations within and across organizations.
3. Critically evaluate and make ethical decisions with consideration for multiple stakeholders.
4. Demonstrate an appreciation for the skills and challenges required in managing a diverse workforce.

Contact

Campus	Great Valley
Graduate Program Head	Zugang Liu
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Denise Potosky
Program Contact	DENISE Y. SMITH 30 East Swedesford Road Malvern PA 19355 dms7338@psu.edu (610) 648-3336
Program Website	View (http://greatvalley.psu.edu/academics/graduate-certificates/human-resource-management/)

Human Resources and Employment Relations Foundations Graduate Credit Certificate Program

Person-in-Charge	Paul F Clark
Program Code	HRER
Campus(es)	University Park World Campus

The program is designed for professionals who desire further education in the specialized field of Human Resources and Employment Relations (HRER). The certificate program provides flexibility for working professionals and advanced knowledge in the rapidly changing field of HRER in many areas, including dispute management and resolution, workplace diversity, work and family, trends in human resources, and technology and the workplace.

Courses taken in the certificate program may be applied toward a master's degree in HRER, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards a graduate degree in HRER

must apply and be admitted to that degree program. Admission to the HRER graduate degree program is a separate step and is not guaranteed.

Effective Semester: Spring 2024

Expiration Semester: Spring 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

- Applicants with a 3.00 junior/senior grade-point average (on a 4.00 scale) will be considered for admission. Exceptions to the minimum grade-point average may be made at the discretion of the program for students with special backgrounds, abilities, and interests;
- All applicants submit a [Graduate School application](#) (including payment of the nonrefundable application fee), resume, and personal statement addressing their reasons for pursuing a certificate in HRER Foundations;
- The resume and personal statement are waived if a student is currently enrolled in the MHRER or MS HRER degree programs

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

All courses must be completed with a grade of C or better and a grade-point average of 3.0 to be awarded the certificate.

Code	Title	Credits
Required Courses		
HRER 501 or HRER 810	Labor and Employment Law	3
HRER 505	Seminar in Human Resources	3
HRER 504	Seminar in Employment Relations	3
HRER 502 or HRER 802	Human Behavior at Work Human Behavior and Organizational Performance	3
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up

deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **KNOW:** Students will be able to demonstrate the necessary basic disciplinary knowledge and competence to develop future ER and HRM careers.
2. **APPLY/CREATE:** Students will be able to apply their knowledge by interacting effectively with organizational leaders in helping to develop and implement organizational strategies.
3. **COMMUNICATE:** Students will be able to effectively communicate knowledge of current HRM and ER topics both verbally and in writing.
4. **THINK:** Students will be able to recognize and analyze practical, legal, and ethical ER and HRM challenges in the workplace.
5. **PROFESSIONAL PRACTICE:** Students will be able to respond appropriately to practical, legal, and ethical ER and HRM challenges in the workplace using both theoretical and practical approaches and in accordance with the standards, values and best practices of their discipline.

Contact

Campus	University Park
Graduate Program Head	Paul Clark
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Brian Francis Redmond
Program Contact	Erin Hetzel 506 Keller Building University Park PA 16802 eab27@psu.edu (814) 867-4167
Program Website	View (http://ler.la.psu.edu/graduates/graduate-certificate-program/)

Campus	World Campus
Graduate Program Head	Paul Clark
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Brian Francis Redmond
Program Contact	Erin Hetzel 506 Keller Building University Park PA 16802 eab27@psu.edu (814) 867-4167

Information Systems Cybersecurity Graduate Credit Certificate Program

Person-in-Charge	Carleen Maitland
Program Code	ISSEC
Campus(es)	World Campus

This graduate credit certificate is designed to provide students with a foundation in information systems cybersecurity. The certificate will enable those completing the program to market to academic institutions, government, and technology-based businesses. Students will be exposed to principles, models, tools, and applications in information security that specifically focus on network security, security and risk

management, digital forensics, knowledge management, crisis and disaster management, and web security and privacy.

The certificate program is an attractive option for those seeking a career change or for individuals working in the industry who have no formal undergraduate academic education in information systems cybersecurity. The certificate is also attractive for individuals who do not wish a full master's degree program or for individuals who might wish to take a certificate to determine if they are interested in a complete postbaccalaureate degree program in Cybersecurity Analytics and Operations.

Courses taken in the certificate program may be applied toward a graduate degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards a graduate degree must apply and be admitted to that degree program. Admission to a graduate degree program is a separate step and is not guaranteed.

Effective Semester: Spring 2022

Expiration Semester: Spring 2027

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

To be awarded the certificate, students must successfully complete 15 credits of course work. A 3.0 GPA must be obtained in order to successfully complete the certificate.

Code	Title	Credits
Required Courses		
IST 803	Cybersecurity Foundations	3
IST 805	Cybersecurity Forensics and Management	3
IST 554	Network Management and Security	3
IST 815	Foundations of Information Security and Assurance	3
Electives		
Select 3 credits from a list of approved electives available from the program office.		3
Total Credits		15

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **APPLY/CREATE:** Integrate the use of disciplinary methods, techniques, and knowledge to solve practical problems.
2. **PROFESSIONAL PRACTICE:** Make use of ethical standards and principles of integrity as a foundation in decision-making.
3. **THINK:** Search, evaluate, and synthesize literature to integrate cyber security principles into disciplines and professional fields.

Contact

Campus	World Campus
Graduate Program Head	Carleen Maitland
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Edward J Glantz
Program Contact	Chrissie Fitzgerald cml195@psu.edu (814) 863-9461
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/information-systems-security-certificate/overview/)

Institutional Research Graduate Credit Certificate Program

Person-in-Charge	Kevin Kinser
Program Code	INSTRH
Campus(es)	World Campus

The primary goal of the Institutional Research certificate program is to improve the skills of individuals on college and university campuses who want to become institutional researchers or who want to strengthen their understanding of how institutional research works. The 15-credit curriculum includes research design, assessment and evaluation of student and faculty issues, enrollment management, and the integration of strategic planning with institutional finance.

Effective Semester: Summer 2024

Expiration Semester: Summer 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students

(<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
HIED 801	Foundations of Institutional Research	3
HIED 830	Designing Institutional Research Studies	3
Electives		
Select 9 credits from the following:		9
HIED 810	Planning and Resource Management in Higher Education	
HIED 840	Assessing Student Outcomes & Evaluating Academic Programs	
HIED 850	Analyzing Faculty Workload, Performance, and Compensation	
HIED 860	Enrollment Management	
HIED 842	Administrative Leadership in Higher Education	
	or HIED 846 College Students and Their Success	
Total Credits		15

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Apply "issues intelligence" within a higher education context to address institutional research needs.
2. Review institutional research requests and needs to determine which role groups – internal and external – must be involved.
3. Analyze data and available information to suggest solutions to institutional needs.
4. Interrogate data and related graphs/figures presented at meetings and to the broader higher education community about assumptions made, sample and population, analyses, and potential responses and uses for certain student and faculty.

Contact

Campus	World Campus
Graduate Program Head	Kevin Kinser
Program Contact	Karen Paulson 405F Rackley Bldg University Park PA 16802 kxp4@psu.edu (814) 863-5553
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/institutional-research-certificate/overview/)

International Affairs Graduate Credit Certificate Program

Person-in-Charge	Mitchell Smith
Program Code	INTLAF
Campus(es)	University Park World Campus

This program provides students, professionals, and others with an accessible, professional education in the rapidly evolving field of international affairs. The certificate builds career options in international relations, public policy, intelligence, defense policy, military affairs, counterterrorism, diplomacy, international organizations, law enforcement, international business, international law, international education, economic development, international environmental policy, and international energy policy.

Effective Semester: Summer 2023

Expiration Semester: Summer 2028

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

All applicants submit an application (including payment of the nonrefundable application fee), two letters of recommendation, and a personal statement addressing their reasons for pursuing a certificate in international affairs and discussing their plans and goals.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

The 12-credit program offers a unique balance of academic study, hands-on training, and professional development; it includes 6 credits of core courses, 3 credits in additional core courses or SIA electives, and 3 credits in additional 500 or 800 level courses. In some cases, at the discretion of the certificate program head, substitution of a relevant course from an appropriate unit may be possible.

All courses must be taken for a letter grade with at least 3.0 grade-point average maintained; no grades below a C will be counted toward the certificate.

Code	Title	Credits
Required Courses		
Select 6 credits from the following:		6
INTAF 506	International Economics: Principles, Policies, and Practices	
INTAF 801	Actors, Institutions, and Legal Frameworks in International Affairs	
INTAF 802	Foundations of Diplomacy and International Relations Theory	
INTAF 803	Multi-sector and Quantitative Analysis	
INTAF 804	Global Cultures and Leadership	
INTAF 890	Colloquium	
Select an additional 3 credits in Core Courses or SIA Elective Courses		3
Select an additional 3 credits in 500 or 800 level courses		3
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Students will be able to identify key issues in the field of international affairs.
2. Students will be able to apply the knowledge they obtain to real-world examples.

Contact

Campus	University Park
Graduate Program Head	Mitchell P Smith
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Mitchell P Smith
Program Contact	Christie Persio The Penn State School of International Affairs Lewis Katz Building University Park PA 16802 czp76@psu.edu (814) 863-0788
Program Website	View (https://www.sia.psu.edu/academics/graduate-certificate-program/international-affairs-certificate/)

Campus	World Campus
Graduate Program Head	Mitchell P Smith
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Mitchell P Smith
Program Contact	Christie Persio czp76@psu.edu (814) 863-0788

International Development Policy Graduate Credit Certificate Program

Graduate Program Head	Mitchell Smith
Program Code	INTLDP
Campus(es)	University Park

This program provides students, professionals, and others with an accessible, professional education in the rapidly evolving field of international development policy. Students can study geopolitical, cultural, and legal aspects of international affairs pertaining to economic development. The certificate is a strong addition to the resume of anyone interested in a career in international relations, public policy, intelligence, defense, military affairs, counterterrorism, diplomacy, NGOs, international business, international law, or economic development.

Effective Semester: Summer 2023

Expiration Semester: Summer 2028

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

All applicants submit an application (including payment of the nonrefundable application fee), two letters of recommendation, and a

personal statement addressing their reasons for pursuing a certificate in international development policy and discussing their plans and goals.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

The 12-credit program offers a unique balance of academic study, hands-on training, and professional development; it includes 3 credits of SIA core courses, 3 credits in additional SIA core courses or SIA electives, and 6 credits in additional 400, 500, or 800 level courses. In some cases, at the discretion of the certificate program head, substitution of a relevant course from an appropriate unit may be possible. All courses must be taken for a letter grade with at least a 3.0 grade-point average maintained; no grades below a C will be counted toward the certificate.

Code	Title	Credits
Required Courses		
3 Credits in SIA Core Courses. Select from the following:		3
INTAF 506	International Economics: Principles, Policies, and Practices	
INTAF 803	Multi-sector and Quantitative Analysis	
3 Credits in Additional SIA Core Courses or SIA Electives		3
6 Credits in Additional 400, 500, and 800 Level Courses on topics relevant to International Development Policy		6
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Students will develop an understanding of economic analysis in the international context.
2. Students will be able to apply the knowledge they obtain to real-world examples.

Contact

Campus	University Park
Graduate Program Head	Mitchell P Smith
Program Contact	Christie Persio The Penn State School of International Affairs Lewis Katz Building University Park PA 16802 czp76@psu.edu (814) 863-0788
Program Website	View (https://www.sia.psu.edu/academics/graduate-certificates/international-development-policy-certificate/)

International Human Resources and Employment Relations Graduate Credit Certificate Program

Person-in-Charge	Paul Clark
Program Code	IHRER
Campus(es)	University Park World Campus

This 9-credit program is designed to provide HR and ER practitioners and those interested in global business practices with a comprehensive understanding of the law, policy, and best practices necessary to effectively manage global human resources, employment relations, and labor relations responsibilities.

Courses taken in the certificate program may be applied toward a master's degree in HRER, subject to restrictions outlined in [GCAC-309 Transfer Credit](#). Certificate students who wish to have certificate courses applied towards a graduate degree in HRER must apply and be admitted to that degree program. Admission to the HRER graduate degree program is a separate step and is not guaranteed.

Effective Semester: Spring 2024
Expiration Semester: Spring 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

- Applicants with a 3.00 junior/senior grade-point average (on a 4.00 scale) will be considered for admission. Exceptions to the minimum grade-point average may be made at the discretion of the program for students with special backgrounds, abilities, and interests;
- All applicants submit a Graduate School application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) (including payment of the nonrefundable application fee), resume, and personal

statement addressing their reasons for pursuing a certificate in international human resources and employment relations;

- The resume and personal statement are waived if a student is enrolled in the MHRER or MS HRER degree programs.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

All courses must be completed with a grade of C or better and a grade-point average of 3.0 to be awarded the certificate.

Code	Title	Credits
Required Courses		
HRER 803 or HRER 503	Human Resources in Multinational Enterprises Seminar in International Human Resources Studies	3
HRER 801 or LGWR 510	Comparative and International Employment and Labor Law International Labor Law	3
LHR 403 or LHR 400	International Human Resource Studies Comparative Employment Relations Systems	3
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **Know:** Graduates will have and be able to demonstrate the necessary advanced knowledge and competence in the fields of International human resources and employment relations to excel in their careers.
2. **Think:** Graduates will be able to recognize and analyze practical, legal, and ethical challenges related to IHRER issues in global workplaces.
3. **Apply/Create:** Graduates will be able to effectively apply relevant theories and practices when solving problems in global workplaces.
4. **Communicate:** Graduates will be able to effectively communicate knowledge of current topics to excel as IHRER professionals.
5. **Professional Practice:** Graduates should display behavior consistent with the highest ethical standards related to IHRER and the online learning environment.

Contact

Campus	University Park
Graduate Program Head	Paul Clark
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Brian Francis Redmond
Program Contact	Erin Hetzel eab27@psu.edu (814) 867-4167
Campus	World Campus
Graduate Program Head	Paul Clark
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Brian Francis Redmond
Program Contact	Erin Hetzel School of Labor and Employment Relations 506 University Park PA 16802 eab27@psu.edu (814) 867-4167
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-international-human-resources-and-employment-relations-certificate/overview/)

International Public Policy Graduate Credit Certificate Program

Person-in-Charge	Mitchell Smith
Program Code	INTPP
Campus(es)	University Park

This program provides students, professionals, and other with an accessible professional education in the rapidly evolving field of international public policy. The certificate will build career options and expand knowledge and skills in the field of international public policy.

Effective Semester: Summer 2023

Expiration Semester: Summer 2028

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

All applicants submit an application (including payment of the nonrefundable application fee), two letters of recommendation, and a personal statement addressing their reasons for pursuing a certificate in international public policy and discussing their plans and goals.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

The 12-credit program offers a unique balance of academic study, hands-on training, and professional development; it includes 9 credits in required courses and 3 broader elective credits. All courses must be taken for a letter grade with at least a 3.0 grade-point average maintained; no grades below a C will be counted toward the certificate.

Code	Title	Credits
Required Courses		
INTAF 890	Colloquium	3
INTAF 508	Domestic Influences on Foreign Policy	3
INTAF 803	Multi-sector and Quantitative Analysis	3
Electives		
Select one of the following:		3
INTAF 810	Energy, International Security, and the Global Economy	
INTAF 510	Cross Cultural Conflict Resolution	
INTAF 504	Political Economy of Development and Growth	
INTAF 814	U.S. Policy in the Middle East	
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Students will be able to identify issues and explain how they affect international public policy.
2. Students will be able to identify and understand ways in which domestic politics influence international public policy.
3. Students will be able to demonstrate knowledge in various methods of analysis.

Contact

Campus	University Park
Graduate Program Head	Mitchell P Smith
Program Contact	Christie Persio The Penn State School of International Affairs Lewis Katz Building University Park PA 16802 czp76@psu.edu (814) 863-0788
Program Website	View (https://www.sia.psu.edu/academics/graduate-certificates/international-public-policy-certificate/)

International Security Studies Graduate Credit Certificate Program

Person-in-Charge	Mitchell Smith
Program Code	INTLSS
Campus(es)	University Park

This program provides students, professionals, and others with an accessible, professional education in the rapidly evolving field of international security studies. Students study geopolitical, cultural, and international law aspects of international affairs pertaining to security dilemmas. The certificate is a strong addition to the resume of anyone interested in a career in international relations, public policy, intelligence, defense, military affairs, counterterrorism, diplomacy, law enforcement, international organizations, or international law.

Effective Semester: Summer 2023

Expiration Semester: Spring 2028

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

All applicants submit an application (including payment of the nonrefundable application fee), two letters of recommendation, and a personal statement addressing their reasons for pursuing a certificate in international security studies and discussing their plans and goals.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

The 12-credit program offers a unique balance of academic study, hands-on training, and professional development; it includes 3 credits of SIA core courses, 3 credits in additional SIA core courses or SIA electives, and 6 credits in additional 400, 500, or 800 level courses. In some cases, at the discretion of the certificate program head, substitution of a relevant course from an appropriate unit may be possible. All courses must be taken for a letter grade with at least a 3.0 grade-point average maintained; no grades below a C will be counted toward the certificate.

Code	Title	Credits
Required Courses		
3 Credits in SIA Core Courses. Select from the following:		3
INTAF 801	Actors, Institutions, and Legal Frameworks in International Affairs	
INTAF 802	Foundations of Diplomacy and International Relations Theory	
3 Credits in Additional SIA Core Courses or SIA Electives		3
6 Credits in Additional 400, 500, and 800 Level Courses on topics relevant to International Security Studies		6
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Students will be able to identify key issues relating to international affairs.
2. Students will be able to apply the knowledge they obtain to real-world examples.

Contact

Campus	University Park
Graduate Program Head	Mitchell P Smith
Program Contact	Christie Persio The Penn State School of International Affairs Lewis Katz Building University Park PA 16802 czp76@psu.edu (814) 863-0788
Program Website	View (https://www.sia.psu.edu/academics/graduate-certificates/international-security-studies-certificate/)

IT Analytics Graduate Credit Certificate Program

Person-in-Charge	Raghu Sangwan
Program Code	ISITA
Campus(es)	Great Valley World Campus

The Graduate Certificate in IT Analytics is a program for students who aim to pursue a career as an IT System and Data Analyst where skills will include responsibilities to design, build, and monitor the IT infrastructure for effectively supporting business operations.

Courses taken in the certificate program may be applied toward a master of science degree in Information Science, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards a graduate degree must apply and be admitted to that degree program. Admission to the graduate degree program is a separate step and is not guaranteed.

Effective Semester: Summer 2024

Expiration Semester: Summer 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

1. The successful applicant is generally expected to have a minimum combined junior/senior grade-point average of 3.0 (B) on a 4.0 scale.
2. Courses taken in the certificate program may be applied toward Master of Software Engineering degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards the Master of Software Engineering must apply and be admitted to that degree program. Admission to the Master of Software Engineering graduate degree program is a separate step and is not guaranteed.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
DAAN 862	Analytics Programming in Python	3
IE 575	Foundations of Predictive Analytics	3

INSC 846	Network and Predictive Analytics for Socio-Technical Systems	3
Total Credits		9

All courses must be completed with a minimum grade of C or better and an overall GPA of 3.0.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Contact

Campus	Great Valley
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Guanghua Qiu
Program Contact	Sharon V. Patterson svp40@psu.edu (610) 648-3318

Campus	World Campus
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Guanghua Qiu
Program Contact	Sharon V. Patterson svp40@psu.edu (610) 648-3318

Labor and Collective Bargaining Postbaccalaureate Credit Certificate Program

Person-in-Charge	Paul Clark
Program Code	LBCOLB
Campus(es)	University Park

The field of labor relations is pivotal to maintaining fair and productive workplaces. The 9-credit Post Baccalaureate Certificate in Labor and Collective Bargaining is designed to equip professionals with the knowledge and skills necessary to navigate complex labor relations issues, negotiate effectively, and contribute to positive labor-management relations.

Courses taken in the certificate program may be applied toward a master's degree in HRER, subject to restrictions outlined in [GCAC-309 Transfer Credit](#). Certificate students who wish to have certificate courses applied towards a graduate degree in HRER must apply and be admitted to that degree program. Admission to the HRER graduate degree program is a separate step and is not guaranteed.

Effective Semester: Spring 2024

Expiration Semester: Spring 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

- Applicants with a 3.00 junior/senior grade-point average (on a 4.00 scale) will be considered for admission. Exceptions to the minimum grade-point average may be made at the discretion of the program for students with special backgrounds, abilities, and interests;
- #All applicants submit a Graduate School application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) (including payment of the nonrefundable application fee), resume, and personal statement addressing their reasons for pursuing a certificate in labor and collective bargaining;
- The resume and personal statement are waived if a student is currently enrolled in the MHRER or MS HRER degree programs.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

All courses must be completed with a grade of C or better and a grade-point average of 3.0 to be awarded the certificate.

Code	Title	Credits
HRER 504	Seminar in Employment Relations	3
Choose 6 credits from the following list:		6
LHR 401	The Law of Labor-Management Relations	
LHR 434	Advanced Collective Bargaining and Contract Administration	
LHR 435	Labor Relations in the Public Sector	
LHR 437	Workplace Dispute Resolution	
LHR 444	Workplace Safety and Health: Principles and Practices	
LHR 459	Collective Bargaining in Professional Sports	
LHR 466	Labor Union Structure, Administration and Governance	
LHR 468	American Labor Unions	
LHR 472	Work-Life Practices and Policies	
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up

deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **Know:** Graduates will have and be able to demonstrate the necessary advanced knowledge and competence in labor and collective bargaining to excel in their careers.
2. **Think:** Graduates will be able to recognize and analyze practical, legal, and ethical challenges related to labor and collective bargaining issues in workplaces.
3. **Apply/Create:** Graduates will be able to conduct independent inquiries to identify current scholarship and best practices and effectively apply relevant theories and practices when solving problems in labor and collective bargaining.
4. **Communicate:** Graduates will be able to effectively communicate knowledge of current topics to excel as labor and collective bargaining professionals.
5. **Professional Practice:** Graduates should display behavior consistent with the highest ethical standards related to labor and collective bargaining.

Contact

Campus	University Park
Graduate Program Head	Paul Clark
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Paul Clark
Program Contact	Erin Hetzel 506 Keller Building University Park PA 16802 eab27@psu.edu (814) 867-4167

Labor and Employment Law Graduate Credit Certificate Program

Person-in-Charge	Paul Clark
Program Code	LBEMPL
Campus(es)	University Park World Campus

This 9-credit program is designed to provide students with a comprehensive understanding of the legal framework governing the workplace. In an era of evolving labor practices and employment regulations, this program equips students with the knowledge and skills necessary to navigate the complexities of labor and employment law.

Courses taken in the certificate program may be applied toward a master's degree in HRER, subject to restrictions outlined in [GCAC-309 Transfer Credit](#). Certificate students who wish to have certificate courses applied towards a graduate degree in HRER must apply and be admitted to that degree program. Admission to the HRER graduate degree program is a separate step and is not guaranteed.

Effective Semester: Spring 2024
Expiration Semester: Spring 2029

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

All courses must be completed with a grade of C or better and a grade-point average of 3.0 to be awarded the certificate.

Code	Title	Credits
Required Courses		
HRER 501	Labor and Employment Law	3
or HRER 810	Labor and Employment Law	
<i>Choose 6 credits from the following:</i>		6
HRER 801	Comparative and International Employment and Labor Law	
HRER 811	Labor and Employment Law II	
LHR 401	The Law of Labor-Management Relations	
LGWR 510	International Labor Law	
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

- Know:** Graduates will have and be able to demonstrate the necessary advanced knowledge and competence in labor and employment law to excel in their careers.
- Think:** Graduates will be able to recognize and analyze practical, legal, and ethical challenges related to labor and employment law issues in workplaces.
- Apply/Create:** Graduates will be able to conduct independent inquiries to identify current scholarship and best practices and effectively apply relevant theories and practices when solving problems related to labor and employment law.
- Communicate:** Graduates will be able to effectively communicate knowledge of current topics to excel as labor and employment law professionals.
- Professional Practice:** Graduates should display behavior consistent with the highest ethical standards related to labor and employment law.

Contact

Campus	University Park
Graduate Program Head	Paul Clark
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Paul Clark
Program Contact	Erin Hetzel 506 Keller Building University Park PA 16802 eab27@psu.edu (814) 867-4167

Campus	World Campus
Graduate Program Head	Paul Clark
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Paul Clark
Program Contact	Erin Hetzel 506 Keller Building University Park PA 16802 eab27@psu.edu (814) 867-4167

Leading in Diversity, Equity & Inclusion Graduate Credit Certificate Program

Person-in-Charge	Zugang Liu
Program Code	LDEI
Campus(es)	Great Valley World Campus

The Graduate Certificate in Leading Diversity, Equity, and Inclusion (DEI) develops students' knowledge in the key characteristics and impact of a comprehensive approach to fostering DEI in organizations and the skills for building an inclusive workplace culture supporting equity. Students learn frameworks and techniques to make mindful and ethical decisions; support and reinforce positive, sustainable change; and build strong business case initiatives to create, engage, and measure an inclusive workplace through communication, mentorship, hiring practices, executive level support, listening, career management and training.

Effective Semester: Fall 2022
Expiration Semester: Fall 2027

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

The successful applicant is generally expected to have a minimum combined junior/senior grade-point average of 3.0 (B) on a 4.0 scale.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

To be awarded the graduate certificate, students must successfully complete 12 credits of course work consisting of 3 required credits and 9 elective credits. All courses must be completed with a minimum grade of C or better and an overall GPA of 3.0.

Code	Title	Credits
Required Courses		
BUSAD/LEAD 556	Diversity Leadership	3
<i>Leading Positive Ethical Change (choose 1):</i>		3
MBADM 815	Ethical and Responsible Business Leadership	
MGMT 507	Positive Organizational Behavior and Wellbeing	
<i>Demonstrating Business Case for Diversity (choose 1):</i>		3
BUSAD 802	Cornerstone of Sustainability	
HRER 836	Diversity in the Workplace	
MGMT 841	Human Resource Management	
BUSAD 843	People Analytics	
<i>Specialized Competencies for DEI Leaders (choose 1):</i>		3
BADM 828	Negotiations	
BUSAD 859	Career Management	
LEAD 561	Dynamic Communication in Leadership Contexts	
HRER 826	Talent Management	
HRER 501	Labor and Employment Law	
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

- Students will develop and implement a personal diversity leadership improvement plan to build expertise in relating with diverse individuals in the workplace.
- Students will demonstrate an understanding of positive organizational behavior to become their best possible self for personal and career advancement.
- Students will diagnose and develop solutions to practical concerns related to the management of people in organizations by applying HRM models, tools, and strategies.

Contact

Campus	Great Valley
Graduate Program Head	Zugang Liu
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Zugang Liu
Program Contact	DENISE Y. SMITH 30 E Swedesford Road Malvern PA 19355 dms7338@psu.edu (610) 648-3336

Campus	World Campus
Graduate Program Head	Zugang Liu
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Zugang Liu
Program Contact	DENISE Y. SMITH 30 E Swedesford Road Malvern PA 19355 dms7338@psu.edu (610) 648-3336

Program Website	View (https://greatvalley.psu.edu/academics/graduate-certificates/dei/)
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Life-Cycle System Design Graduate Credit Certificate Programs

Person-in-Charge	Raghu Sangwan
Program Code	MEMLCD
Campus(es)	Great Valley World Campus

The Graduate Certificate in Life-cycle System Design is a program for students who aim to pursue a career as a System Architect, Lead System Engineer, System Requirements Engineer, System Engineer, or System Integration Engineer where skills will include responsibilities to analyze, architect, design, implement and manage the technical development aspects of a system, design, implement, and coordinate technical design aspects of a system, identify, document, and manage requirements, develop, and document technical aspects of system in any life cycle phase (concept, design, implementation, operation, maintenance), or develop and manage interoperability across systems.

Courses taken in the certificate program may be applied toward a master's degree in Systems Engineering, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards a graduate degree must apply and be admitted to that degree program. Admission to the graduate degree program is a separate step and is not guaranteed.

Effective Semester: Spring 2024
Expiration Semester: Spring 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies

(<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

1. The successful applicant is generally expected to have a minimum combined junior/senior grade-point average of 3.0 (B) on a 4.0 scale.
2. Courses taken in the certificate program may be applied toward Master of Systems Engineering degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards the Master of Systems Engineering must apply and be admitted to that degree program. Admission to the Master of Software Engineering graduate degree program is a separate step and is not guaranteed.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
SYSEN 555	Invention and Creative Design	3
SWENG 586	Requirements Engineering	3
SYSEN 880	Systems Architecture and Models	3
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **KNOW:** Elicit requirements for a complex system problem and effectively communicate with system stakeholders
2. **APPLY/CREATE:** Develop heterogeneous engineered solutions to complex problems using contemporary methods, processes, and tools.

Contact

Campus	Great Valley
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Nil Hande Ergin
Program Contact	MICHELLE WHALEN 30 E. Swedesford Rd. Malvern PA 19355 mmw6441@psu.edu
Campus	World Campus
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Nil Hande Ergin
Program Contact	MICHELLE WHALEN 30 E. Swedesford Rd. Malvern PA 19355 mmw6441@psu.edu

Management Accounting Graduate Credit Certificate Program

Person-in-Charge	Zugang Liu
Program Code	MGACT
Campus(es)	Great Valley

The Graduate Certificate in Management Accounting (GCMA) prepares students to learn how to use timely managerial accounting information to facilitate decision-making by business owners, managers, and employees. Throughout the GCMA, students will learn to:

1. Develop a deep understanding of evaluating business performance using accounting information; and
2. Apply management accounting knowledge analyzing and offering recommendations to improve business performance.

Effective Semester: Fall 2022

Expiration Semester: Fall 2027

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Applicants must hold either 1) a baccalaureate degree from a regionally accredited U.S. institution or 2) a tertiary (post-secondary) degree that is deemed comparable to a four-year bachelor's degree from a regionally accredited U.S. institution. This degree must be from an officially recognized degree-granting institution in the country in which it operates. The successful applicant is generally expected to have a

minimum combined junior/senior grade-point average of 3.0 (B) on a 4.0 scale.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

To be awarded the graduate certificate, students must successfully complete 9 credits of course work consisting of 6 required credits and 3 elective credits. All courses must be completed with a minimum grade of C or better and an overall GPA of 3.0.

Code	Title	Credits
Required Courses		
ACCTG 800	Financial and Managerial Accounting	3
ACCT 545	Strategic Cost Management	3
<i>Choose one of the following courses:</i>		
ACCT 550	Professional Responsibilities and Ethics in Accounting	3
ACCT 532	Accounting Information and Decision Systems	
MBADM 820	Financial Management	
BUSAD 809	Triple Bottom Line Accounting	
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

- Students will be able to analyze an organization's financial statements and compare to industry and key competitors.
- Students will be able to identify and explain the application of data mining technologies within organizations.
- Students will analyze and assess basic flaws in accounting systems and internal controls and evaluate actions/decisions in terms of ethical components.

Contact

Campus	Great Valley
Graduate Program Head	Zugang Liu
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Bo Ouyang
Program Contact	DENISE Y. SMITH 30 E Swedesford Road Malvern PA 19355 dms7338@psu.edu (610) 648-3336
Program Website	View (https://greatvalley.psu.edu/academics/graduate-certificates/management-accounting/)

Management Consulting Graduate Credit Certificate Program

Person-in-Charge	Brian Cameron
Program Code	MGTCNS
Campus(es)	World Campus

The graduate certificate in Management Consulting is a 9-credit program that covers key issues, concepts, methodologies, tools, and techniques associated with management consulting. Topics include the professional services industry and industry best practices, engagement management, consulting agreements and contracts, commonly used frameworks and analytical tools, communication tools, as well as a variety of client contexts where advisory services are needed.

Effective Semester: Spring 2020
Expiration Semester: Spring 2025

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Exceptions to GCAC-305 (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) will be considered by the program. Exceptions may or may not be granted by the Graduate School.

Other admissions requirements include:

- **Application** – Complete a Graduate School application (<http://gradschool.psu.edu/graduate-admissions/how-to-apply/>) including a nonrefundable application fee.
- **Statement of Purpose** – Submit a statement describing how professional experience and goals align with the certificate.
- **Vita or resume** – Submit a statement outlining professional experience history.

GRE/GMAT scores are NOT required.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
MGMT 880	Business Transformation Consulting	3
MGMT 885	Management Consulting Methods and Practice	3
Choose one course from the following list of relevant courses:		3
BA 805	Negotiation Theory and Skills	
BA 809	Strategic Business Architecture	
BA 865	Strategic Leadership	
BA 888	Executive Leadership	
ENTR 502	Business Modeling and New Venture Creation	
ENTR 810	Emerging Trends, Technology, and Corporate Innovation	
ENTR 820	Corporate Innovation Strategies and Entrepreneurial Methods	
MBADM 531	Corporate Innovation and Entrepreneurship	
MBADM 571	Global Strategic Management	
MGMT 565	Power and Influence	
MGMT 831	Strategy Implementation and Organizational Change	
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

- Explain the role of a management consultant, why firms hire management consultants, and how management consultants create value for their clients in a variety of contexts
- Explain the engagement life cycle for a management consulting engagement
- Apply basic secondary and primary research methods and tools in a management consulting context
- Apply commonly used tools and techniques for analysis and solution generation in a management consulting context
- Develop an actionable plan for implementing change within a firm that appropriately incorporates generally accepted concepts and theories related to change management
- Apply commonly used communication related tools and techniques used to enable the success of a management consulting engagement.

- Identify best practice methods used to develop key client deliverables, such as business cases, cost estimations, recommendations, and final reports.
- Relate and integrate consulting engagement management to project, program, and portfolio management and begin to apply them in client settings.
- Pursue an elective area of specialization

Contact

Campus	World Campus
Graduate Program Head	Brian Harold Cameron
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Shawn Clark
Program Contact	Michelle Kristen Rockower mkk114@psu.edu (814) 865-5290
Program Website	View (https://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-management-consulting-certificate/overview/)

Management Essentials Graduate Credit Certificate Program

Person-in-Charge	Zugang Liu
Program Code	MGMTES
Campus(es)	Great Valley

The Graduate Certificate in Management Essentials provides students with fundamental business skills that are necessary in almost any career today. The program is designed for people who are moving up the career ladder and whose responsibilities now require a diverse set of skills including people and team management, business development, and strategic decision making. Courses in this program provide a broad introduction of the core principles of business in areas such as organizational behavior, marketing, economic theory, and managing enterprises in a digital age.

The program emphasizes the role of a senior manager or business owner who is in a position of making strategic decisions for a company. Upon completion, students will learn effective leadership strategies to motivate teams and individuals, the role of organizational culture in shaping those strategies, market segmentation and product placement, how economic forces shape the markets, and strategies for managing in the digital age. These versatile skillsets are highly valued by any employer and provides confidence to business owners to adapt their strategies as markets and conditions change.

Effective Semester: Fall 2022

Expiration Semester: Summer 2027

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement;

see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

The successful applicant is generally expected to have a minimum combined junior/senior grade-point average of 3.0 (B) on a 4.0 scale.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

To be awarded the graduate certificate, students must successfully complete 9 credits of course work consisting of 3 required credits and 6 elective credits. All courses must be completed with a minimum grade of C or better and an overall GPA of 3.0.

Code	Title	Credits
Required Courses		
MGMT 501	Behavioral Science in Business	3
Choose 2 elective courses from the following:		6
BA 800	Marketing Management	
BUSAD 523	Prices and Markets	
BUSAD 837	Managing Digital Enterprises	
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

- Students will understand the issues surrounding the management of groups and individuals.
- Understand the key concepts, analytical perspectives, and decision tools of marketing that aid in market evaluation and planning.
- Predict firm and individual behavior based on the process of rational decision making.

Contact

Campus	Great Valley
Graduate Program Head	Zugang Liu
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Sagnika Sen
Program Contact	DENISE Y. SMITH 30 E Swedesford Road Malvern PA 19355 dms7338@psu.edu (610) 648-3336
Program Website	View (https://greatvalley.psu.edu/academics/graduate-certificates/management-essentials/)

Marketing Analytics Graduate Credit Certificate Program

Person-in-Charge	Chelsea C. Hammond
Program Code	MKTANL
Campus(es)	World Campus

The Graduate Certificate in Marketing Analytics is a 12-credit online program focused on building a core understanding of key functions in the field of marketing analytics. The program focuses on how marketing analytics are (1) applied within organizations, (2) conducted, and (3) meaningfully communicated and applied to business decision-making and strategy. The curriculum is geared towards college graduates interested in developing skills in marketing analytics functions, but who may have little or no formal training in the field. The certificate is industry applicable, since it is aimed at giving professionals the core knowledge they need to successfully apply marketing analytics in today's data-driven organizations.

Effective Semester: Spring 2024

Ending Semester: Spring 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Exceptions to GCAC-305 (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) will be considered by the program. Exceptions may or may not be granted by the Graduate School.

Along with the submission of the online application and the nonrefundable application fee, the following are required:

- **Statement of Purpose** — Applicants must describe how professional experience and goals align with the Certificate in Marketing Analytics, not to exceed 500 words.

- Vita or Résumé – Provide a one- to two-page listing of professional experience and education.
- Application –Completion of the Graduate School certificate application.

GRE or GMAT test scores are NOT required.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
MKTG 811	Driving Business Success with Marketing Analytics	3
MKTG 812	Evaluating Marketing Communications in the Digital World	3
MKTG 813	Data-Driven Customer Acquisition & Retention	3
MKTG 814	Analytics for Brand Management and Customer Experience	3
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **Communication Skills:** Students will know how to formulate and articulate results, analysis, and strategic action plans individually and collaboratively in written, oral, or presentation form.
2. **Professional Skills and Problem Solving:** Using relevant tools, analytic theories, and professional observations students will be able to conduct analyses that transform data into meaningful information.
3. **Integrative Understanding:** Using marketing theory, students will understand how to apply data and analytics to brand management, consumer behavior, market profiling, digital communications, and the acquisition and retention of customers.

Contact

Campus	World Campus
Graduate Program Head	Chelsea C Hammond
Program Contact	Michelle Kristen Rockower mkk114@psu.edu (814) 865-5290
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-marketing-analytics-certificate/overview/)

Natural Language Processing Graduate Credit Certificate Program

Person-in-Charge	Raghu Sangwan
Program Code	MAINLP
Campus(es)	Great Valley World Campus

The Natural Language Processing (NLP) Graduate Certificate prepares students for working as an NLP Engineer who will analyze, identify, architect, design, and implement NLP based systems. Students master the following skill set essential to this industry role:

- Identifying NLP tasks
- Framing NLP problems (language translation, chatbots, speech recognition, language models, etc.)
- Designing NLP pipelines to collect and preprocess textual data.
- Building and evaluating NLP models based on deep neural networks.
- Implementing explainable and interpretable NLP models.
- Evaluating ethical and fairness in NLP tasks

Courses taken in the certificate program may be applied toward a master's degree in Artificial Intelligence, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards a graduate degree must apply and be admitted to that degree program. Admission to the graduate degree program is a separate step and is not guaranteed.

Effective Semester: Spring 2024

Expiration Semester: Spring 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

1. The successful applicant is generally expected to have a minimum combined junior/senior grade-point average of 3.0 (B) on a 4.0 scale.
2. Courses taken in the certificate program may be applied toward Master of Software Engineering degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards the Master of Software Engineering must apply and be admitted to that degree program. Admission to the Master of Software Engineering graduate degree program is a separate step and is not guaranteed.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/>)

gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/).

Code	Title	Credits
Required Courses		
A-I/DAAN 570	Deep Learning	3
A-I 574	Natural Language Processing	3
A-I 804	Ethics of Artificial Intelligence	3
Total Credits		9

All courses must be completed with a minimum grade of C or better and an overall GPA of 3.0.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **KNOW** - Demonstrate proficiency in mastering deep neural networks, ethical and foundational concepts in Natural Language Processing tasks.
2. **APPLY/CREATE** - Demonstrate mastery of concepts and methods for modeling, designing, developing, and testing ethically and responsible NLP applications.

Contact

Campus	Great Valley
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Youakim Badr
Program Contact	Sharon V. Patterson 30 E. Swedesford Rd. Malvern PA 19355 svp40@psu.edu (610) 648-3318
Campus	World Campus
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Youakim Badr
Program Contact	Sharon V. Patterson 30 E. Swedesford Rd. Malvern PA 19355 svp40@psu.edu (610) 648-3318

Negotiation and Influence Graduate Credit Certificate Program

Person-in-Charge	Stephen Humphrey
Program Code	NEGINF
Campus(es)	World Campus

The Graduate Certificate in Negotiation and Influence is offered by the Smeal College of Business. The Negotiation and Influence certificate covers basic to advanced content on negotiation skills, delivering students a combination of negotiation theory, case discussion, and hands-on trial and error learning in an effort to identify, refine, and develop negotiation capabilities. The Negotiation certificate will provide students with knowledge, skills, and practical tools for developing the critical social relation capabilities necessary for success at work.

Course content focuses on: (1) the development of critical dyadic negotiation knowledge and skills; (2) refinement of the skills in an expansion to a multiparty context; (3) helping students identify and gain sources of power at work; and (4) learn how to influence others both with and without the use of power.

Effective Semester: Spring 2024
Expiration Semester: Spring 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Exceptions to GCAC-305 (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) will be considered by the program. Exceptions may or may not be granted by the Graduate School.

Other admissions requirements include:

- Statement of Purpose – Applicants must describe how professional experience and goals align with the Certificate in Negotiation and Influence, not to exceed 500 words.
- Vita or Résumé – Provide a one- to two-page listing of professional experience and education.
- Application – Completion of the Graduate School certificate application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>).

GRE/GMAT scores are NOT required.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/>)

gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/).

Code	Title	Credits
Required Courses		
BA 805	Negotiation Theory and Skills	3
MGMT 821	Complex Negotiations	3
MGMT 565	Power and Influence	3
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

- Graduates will be able to demonstrate competency in the foundational concepts and practices of effective negotiation
- Graduates will learn the how to prepare for a negotiation, including identifying their (and their counterparts') interests, effectively operationalize and quantify their interests, and develop a strategy for engaging in a successful negotiation
- Graduates will learn about the ethical challenges associated with negotiation
- Graduates will be able to demonstrate competency in managing various multiparty negotiation contexts, including third-party interventions
- Graduates will learn about the sources of power and be able to effectively manage downwards, horizontally, and upwards
- Graduates will learn how to influence without power, and demonstrate this capability

Contact

Campus	World Campus
Graduate Program Head	Stephen Humphrey
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Stephen Humphrey
Program Contact	Michelle Kristen Rockower mkk114@psu.edu (814) 865-5290
Program Website	View (https://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-negotiation-and-influence-certificate/overview/)

Nonprofit Administration Graduate Credit Certificate Program

Person-in-Charge	Triparna Vasavada
Program Code	CLNPFT
Campus(es)	Harrisburg

The certificate program in Nonprofit Administration is offered by the Master of Public Administration program at Penn State Harrisburg, which is accredited by the National Association of Schools of Public Affairs and Administration.

This certificate is delivered in person via Penn State Harrisburg.

Purpose/Who Should Apply/What You Will Learn

The purpose of the certificate is to provide comprehensive knowledge of the dynamics of conceptualizing, managing, and leading the nonprofit sector. You will gain knowledge in the following areas:

- Functions and uniqueness of nonprofit organizations
- Fundraising in nonprofit organizations
- Financial management of government and nonprofit organizations
- Effective leadership practices, board development, and management strategies in nonprofit organizations

The certificate is designed for individuals interested in future careers in the nonprofit sector or working in and with the nonprofit sector in various roles such as directors, CEOs, staff, board members, philanthropists, and volunteers.

The certificate program in Nonprofit Administration requires taking four courses (12 credits) – three required and one elective course.

Courses taken in this certificate program may be applied toward the completion of the MPA program.

Effective Semester: Summer 2022

Expiration Semester: Summer 2026

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

1. Applicants must have a GPA of 3.0 in the last two years of undergraduate work.
2. Applicants must have at least two years of managerial or administrative experience in the nonprofit sector.

If a student who is already enrolled in a graduate degree program wishes to enroll in this graduate credit certificate program as well, he/she must do so by completing the online certificate application and paying the nonrefundable application fee.

Students who are already enrolled in the Public Administration degree program at Penn State Harrisburg must complete a "Notice of Intent" form as well in order to enroll in the certificate program. These students can choose elective courses for their M.P.A. degree program in accordance with the requirements of the certificate program in order to earn the certificate in Nonprofit Administration. Courses taken in the certificate program may be applied toward a graduate degree in Public Administration, subject to restrictions outlined in GCAC-309 Transfer

Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>).

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

The certificate program consists of four graduate courses (12 credits). All courses must be at the 500 level. Students are required to take three required courses and one elective course of their choice. All courses must be taken for a letter grade with at least a 3.0 average maintained; no grades below a C will be counted toward the certificate.

Code	Title	Credits
Required Courses		
PADM 517	Nonprofit Organizations: History and Evolution	3
PADM 518	Nonprofit Organizations: Management and Leadership	3
PADM 519	Nonprofit Organizations: Resource Development and Management	3
Electives		
Students are required to take one elective 3-credit course. Students are free to choose any 3-credit course at the 500 level that is relevant to their interest. Following is the suggested list of courses from which students can choose.		3
PADM 510	Organization Behavior	
PADM 514		
PADM 516	Strategic Planning	
PADM 522	Government Financial Management	
PADM 523	Governmental and Nonprofit Accounting	
PADM 550	Policy and Program Evaluation	
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Explain the key issues in administration (leadership challenges strategic planning fundraising, volunteer management, evaluation and accountability, fundraising, government contracting) and its importance for nonprofit organizations.
2. Describe the unique role that nonprofit organization play in the society as independent organizations and collaborators in various capacity.
3. Identify and describe the unique challenges that nonprofit organization face in managing the external environment as well as internal organizational issues.

4. Apply knowledge and skills learned about leadership, management and fundraising to address the critical issues of resource development and management of organizations.

Contact

Campus	Harrisburg
Graduate Program Head	Triparna B Vasavada
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Younhee Kim
Program Contact	Autumn D Wise W159 Olmsted Bldg 777 W. Harrisburg Pike Middletown PA 17057 adw5533@psu.edu (717) 948-6773
Program Website	View (https://harrisburg.psu.edu/public-affairs/public-administration/certificate-program-non-profit-administration/)

Nurse Administrator Graduate Credit Certificate Program

Person-in-Charge	Judith Hupcey
Program Code	NSGADM
Campus(es)	World Campus

The purpose of the Nurse Administrator graduate credit certificate is to prepare nurses with a baccalaureate or higher degree in Nursing for certification as a nurse administrator.

Effective Semester: Spring 2022
Expiration Semester: Spring 2027

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Applicants must hold a Bachelor's or higher degree in nursing from a U.S. regionally accredited institution or from an officially recognized degree-granting international institution. Official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>) must accompany the application. Prior to an applicant's admission, transcripts are evaluated by the Graduate Admissions Committee to ascertain the applicant's potential for successful completion of the core courses. A recommendation regarding admission is discussed with the Associate Dean for Graduate Education and Research prior to making an offer of admission to this certificate program.

Applicants must hold a current license to practice professional nursing in the United States or a foreign country.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

The certificate requires completion of three 3-credit graduate-level nurse administrator didactic courses (9 credits); an optional practicum course (4 credits) is available as well. All courses are delivered using distance technology and are available through the World Campus.

Code	Title	Credits
Required Courses		
NURS 845	Healthcare Economics and Policy for Nurse Administrators	3
NURS 846	Leadership Concepts and Theories for Nurse Administrators	3
NURS 847	Human Resource and Work Force Issues for Nurse Administrators	3
<i>Optional Practicum Course</i>		
NURS 848	Synthesis and Application of the Nurse Administrator Role	
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

Provide essential knowledge, skills and abilities relevant to the nurse administrator role for successful evidence-based application of a variety of leadership and management concepts in health care settings. Specific outcomes for students include:

1. Evaluate organizational, leadership and change theories.
2. Analyze factors that influence the business and economics of health care.
3. Describe principles for the recruitment and retention of a diverse work force.
4. Demonstrate varied role expectations of the nurse administrator in a healthcare setting.

Contact

Campus	World Campus
Graduate Program Head	Judith E Hupcey
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Sheri Matter
Program Contact	Cassidy Shull 201 Nursing Sciences Building University Park PA 16802 crh5490@psu.edu (814) 865-0368
Program Website	View (http://www.nursing.psu.edu/graduate/certificates/)

Nurse Educator Graduate Credit Certificate Program

Person-in-Charge	Judith Hupcey
Program Code	NSGED
Campus(es)	World Campus

The purpose of the Nurse Educator certificate is to provide nurses with a baccalaureate degree or higher in nursing formal content in nursing education for those who plan to teach in a variety of educational and clinical settings.

Effective Semester: Spring 2022
Expiration Semester: Spring 2027

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Applicants must hold a Bachelor's or higher degree in nursing from a U.S. regionally accredited institution or from an officially recognized degree-granting international institution. Official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>) must accompany the application. Prior to an applicant's admission, transcripts are evaluated by the Graduate Admissions Committee to ascertain the applicant's potential for successful completion of the core courses. A recommendation regarding admission is discussed with the Associate Dean for Graduate Education and Research prior to making an offer of admission to this certificate program.

Applicants must hold a current license to practice professional nursing in the United States or a foreign country.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate

Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

The certificate requires completion of three 3-credit graduate-level nurse educator didactic courses (9 credits); an optional 4-credit nurse educator practicum is available as well. All courses are delivered using distance technology and are available through the World Campus.

Code	Title	Credits
Required Courses		
NURS 840	Nursing Education Theories and Strategies	3
NURS 841	Assessment and Evaluation in Nursing Education	3
NURS 842	Curriculum and Program Development in Nursing Education	3
<i>Optional Practicum Course</i>		
NURS 843	Synthesis and Application of the Nurse Educator Role	
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

Provide essential knowledge, skills and abilities relevant to the nurse educator role for successful evidence-based application of a variety of educational and health care settings. Specific outcomes for students include:

1. Develop nursing curriculum based upon relevant contextual forces.
2. Design methods of assessment and evaluation of learning in classroom and clinical settings.
3. Evaluate evidence-based teaching strategies for classroom, clinical practice, and on-line educational settings.
4. Demonstrate multiple aspects of the nurse educator role in academic and/or health care settings.

Contact

Campus	World Campus
Graduate Program Head	Judith E Hupcey
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Sheri Matter
Program Contact	Cody Hoffman 201 Nursing Sciences Building University Park PA 16802 cah82@psu.edu (814) 865-0865
Program Website	View (http://www.nursing.psu.edu/graduate/certificates/)

Organization Development and Change: Analytics Graduate Credit Certificate Program

Person-in-Charge	Susan Land
Program Code	ODCA
Campus(es)	University Park

The focus of this certificate program is for students to learn about the use of analytical tools and approaches as they apply to organization development and change initiatives. This includes approaches to evaluating organization development (OD) and consulting services; assessing and feeding back data in organization development; models to evaluate investments; and the use of data analysis tools.

Effective Semester: Fall 2020

Expiration Semester: Fall 2025

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Students may select any 3 courses from the four courses listed.

Code	Title	Credits
Required Courses		
Select three of the following:		9
WFED 585	Appraising Organization Change and Development and Consulting	
WFED 582	Assessing Data: Organizational Diagnosis	
WFED 543	Evaluation of Investments in Workforce Education and Development	
WFED 540	Data Analysis in Workforce Education and Development	
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up

deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **OBTAIN KNOWLEDGE BASE:** Students will obtain a critical knowledge base in organization development and change, appreciative inquiry, and process consultation.
2. **LEAD GROUPS:** Students will strategically lead both small group and large group change initiatives.
3. **USE RESOURCES:** Students will use various resources for developing, implementing, evaluating, and marketing organization development programs.
4. **OBSERVE AND FACILITATE CHANGE:** Students will observe group dynamics and facilitate change efforts.

Contact

Campus	University Park
Graduate Program Head	Susan Land
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Heather Toomey Zimmerman
Program Contact	Whitney A DeShong Learning and Performance Systems 303 Keller Building University Park PA 16802 wad5021@psu.edu (814) 865-0473
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/organization-development-and-change-analytics-certificate/)

Organization Development and Change: Consulting Skills Graduate Credit Certificate Program

Person-in-Charge	Susan Land
Program Code	ODCCS
Campus(es)	University Park World Campus

To become effective OD consultants and OD practitioners hands-on experience is necessary. After completing the certificate program, students will have skills and competencies that can be applied to help the organizations they serve continuously improve and maximize potential as OD consultants and OD practitioners. All candidates are required to take the 12-credits of prescribed courses related to consulting skills for organization development and change.

Effective Semester: Summer 2020

Expiration Semester: Summer 2025

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies

(<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

To be awarded the Certificate in Organization Development and Change: Consulting Skills, students must successfully complete 12 credits of course work in the courses listed below.

Code	Title	Credits
Required Courses		
WFED 572	Foundations in Organization Development and Change	3
WFED 881	Marketing Organization Development *	3
WFED 884	Appreciative Inquiry *	3
WFED 582	Assessing Data: Organizational Diagnosis *	3
*TRDEV 565 is an approved substitution for one of the starred courses listed above.		
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **OBTAIN KNOWLEDGE BASE:** Students will obtain a critical knowledge base in organization development and change, appreciative inquiry, and process consultation.
2. **LEAD GROUPS:** Students will strategically lead both small group and large group change initiatives.
3. **USE RESOURCES:** Students will use various resources for developing, implementing, evaluating, and marketing organization development programs.
4. **OBSERVE AND FACILITATE CHANGE:** Students will observe group dynamics and facilitate change efforts.

Contact

Campus	University Park
Graduate Program Head	Susan Land
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Heather Toomey Zimmerman
Program Contact	Learning and Performance Systems 303 Keller Building University Park PA 16802
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/organization-development-and-change-operational-excellence-certificate/)

Campus	World Campus
Graduate Program Head	Susan Land
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Heather Toomey Zimmerman
Program Contact	Whitney A DeShong Learning and Performance Systems 303 Keller Building University Park PA 16802 wad5021@psu.edu (814) 865-0473
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/organization-development-and-change-operational-excellence-certificate/)

Organization Development and Change: Essentials Graduate Credit Certificate Program

Person-in-Charge	Susan Land
Program Code	ODCESS
Campus(es)	University Park World Campus

The primary goal of the certificate programs is to provide essential knowledge skills in organization development and change, facilitation of groups and teams, appreciative inquiry, and process consultation. The certificate program focuses on exposing students to global issues and the way change occurs around and within organizations. Emphasis is placed on the importance of knowledge and skills when it comes to facilitating change initiatives from a humanistic perspective.

Effective Semester: Summer 2021
Expiration Semester: Spring 2026

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International

applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

To be awarded the Certificate in Organization Development and Change: Essentials, students must successfully complete 12 credits of course work in the courses listed below.

Code	Title	Credits
Required Courses		
WFED 572	Foundations in Organization Development and Change	3
WFED 578	Process Consultation in Organization Development	3
WFED 880	Facilitating Groups and Teams *	3
WFED 884	Appreciative Inquiry *	3
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

- OBTAIN KNOWLEDGE BASE:** Students will obtain a critical knowledge base in organization development and change, appreciative inquiry, and process consultation.
- LEAD GROUPS:** Students will strategically lead both small group and large group change initiatives.
- USE RESOURCES:** Students will use various resources for developing, implementing, evaluating, and marketing organization development programs.
- OBSERVE AND FACILITATE CHANGE:** Students will observe group dynamics and facilitate change efforts.

Contact

Campus	University Park
Graduate Program Head	Susan Land
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Heather Toomey Zimmerman
Program Contact	Learning and Performance Systems 303 Keller Building University Park PA 16802
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/organization-development-and-change-essentials-certificate/)

Campus	World Campus
Graduate Program Head	Susan Land
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Heather Toomey Zimmerman
Program Contact	Whitney A DeShong Learning and Performance Systems 303 Keller Building University Park PA 16802 wad5021@psu.edu (814) 865-0473
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/organization-development-and-change-essentials-certificate/)

Organization Development and Change: Occupational Safety and Health Graduate Credit Certificate Program

Person-in-Charge	Susan Land
Program Code	ODCOSH
Campus(es)	University Park

Accidents in the workforce and educational environments are metaphorically similar to a line of falling dominoes. As one incident occurs, it has the ability to trigger a harmful chain reaction. Therefore the Organization Development and Change, Occupational Safety and Health Certificate Program is designed to assist workforce development professionals in building the skills and abilities needed to create and support workplaces and educational environments that are free of occupational safety and health hazards. Emphasis is placed on leadership development to promote detection, analysis, and correction of unsafe workplace conditions and procedures.

Effective Semester: Fall 2020

Expiration Semester: Fall 2025

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to

Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

To be awarded the Certificate in Organization Development and Change: Occupational Safety and Health, students must successfully complete 9 credits of course work in the required courses listed below.

Code	Title	Credits
Required Courses		
WFED 573	Needs Assessment for Workforce Development Professionals	3
WFED 411	Occupational Safety and Health for Workforce Education and Development Professionals	3
WFED 806	Program and Facilities Management for Work Force Development Professionals	3
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

- OBTAIN KNOWLEDGE BASE:** Students will obtain a critical knowledge base in organization development and change, appreciative inquiry, and process consultation.
- LEAD GROUPS:** Students will strategically lead both small group and large group change initiatives.
- USE RESOURCES:** Students will use various resources for developing, implementing, evaluating, and marketing organization development programs.
- OBSERVE AND FACILITATE CHANGE:** Students will observe group dynamics and facilitate change efforts.

Contact

Campus	University Park
Graduate Program Head	Susan Land
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Heather Toomey Zimmerman
Program Contact	Whitney A DeShong Learning and Performance Systems 303 Keller Building University Park PA 16802 wad5021@psu.edu (814) 865-0473
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-occupational-safety-and-health-certificate/)

Organization Development and Change: Operational Excellence Graduate Credit Certificate Program

Person-in-Charge	Susan Land
Program Code	ODCOE
Campus(es)	University Park World Campus

This certificate program teaches students how to change corporate culture from a continuous process improvement perspective. Recognizing that organizations either get better or worse, the focus of this certificate is on the tools and methodologies for making positive organizational impact. Emphasis is placed on the application of essential continuous improvement methodologies including lean and six sigma concepts to improve processes in any industry. A focus is also placed on the concepts and skills needed to complete project initiatives on time and within budget.

Effective Semester: Summer 2020

Expiration Semester: Spring 2025

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
WFED 572	Foundations in Organization Development and Change	3
WFED 880	Facilitating Groups and Teams	3
WFED 451	Lean-Sigma for Professionals	3
WFED 405	Project Management for Professionals	3
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **OBTAIN KNOWLEDGE BASE:** Students will obtain a critical knowledge base in organization development and change, appreciative inquiry, and process consultation.
2. **LEAD GROUPS:** Students will strategically lead both small group and large group change initiatives.
3. **USE RESOURCES:** Students will use various resources for developing, implementing, evaluating, and marketing organization development programs.
4. **OBSERVE AND FACILITATE CHANGE:** Students will observe group dynamics and facilitate change efforts.

Contact

Campus	University Park
Graduate Program Head	Susan Land
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Heather Toomey Zimmerman
Program Contact	Learning and Performance Systems 303 Keller Building University Park PA 16802
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/organization-development-and-change-operational-excellence-certificate/)

Campus	World Campus
Graduate Program Head	Susan Land
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Heather Toomey Zimmerman
Program Contact	Whitney A DeShong Learning and Performance Systems 303 Keller Building University Park PA 16802 wad5021@psu.edu (814) 865-0473
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/organization-development-and-change-operational-excellence-certificate/)

Organizational Leadership Graduate Credit Certificate Program

Person-in-Charge	Alfred Warner
Program Code	ORGLDR
Campus(es)	Erie

The Graduate Certificate in Organizational Leadership is designed to enhance essential skills for making effective decisions in changing business environments. The certificate's required courses provide a strong foundation in management theory, building on the concepts of organizational behavior and leadership. Students will acquire technical skills for developing analytical approaches and improve critical thinking abilities through hands-on coursework and case studies. Real-world examples will be covered in a team and organizational culture, leadership, negotiations, and managing organizational change.

In addition to being an excellent stand-alone credential, all of the courses in the Graduate Certificate in Organizational Leadership can be applied toward the blended MBA program offered through Penn State's Behrend Campus. However, successful completion of the certificate neither guarantees nor implies acceptance into any graduate program at Penn State. Admission to the MBA graduate degree program is a separate step and is not guaranteed. Approval to apply non-degree graduate credits toward a degree program must be granted by the student's academic adviser, the program head or graduate officer, and the Graduate School. A maximum of 15 credits earned as a non-degree student may be applied to a degree program, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>).

Effective Semester: Fall 2021

Expiration Semester: Fall 2026

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/>

[gcac-300/gcac-305-admission-requirements-international-students/](https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/)) for more information.

An applicant must demonstrate fundamental competence in Management, Economics, and Statistics either by attaining a B or better in MGMT 301, ECON 102 or ECON 104, and SCM 200 or equivalents, or by completing an online training module as designated by the program.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

All candidates are required to take 12 credits in four courses (managing effective organizations, leadership and ethics, negotiations, and organizational change).

Code	Title	Credits
Required Courses		
BADM 512	Managing Effective Organizations	3
BADM 526	Leadership and Ethics	3
BADM 828	Negotiations	3
MGMT 823	Organizational Change: Theory and Practice	3
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Understand the individual, group, and organizational level drivers of behavior with an emphasis on discrimination and biases, motivation, decision making, communication, and organizational culture.
2. Recognize ethical issues, identify stakeholders affected by decisions and actions, analyze an ethical dilemma by applying multiple ethical theories and formulate a plan of action for resolving it.
3. Understand how leaders manage people and organizations to achieve effective and ethical performance and vary their leadership approaches in response to situational demands
4. Recognize negotiation situations, understand how negotiation works, and determine when to seek a negotiated agreement.
5. Know how to prepare for and take part in negotiations and obtain successful results.
6. Understand the fundamental theories and models of change processes, types of organizational change and the basic models for organizational structure, as well as the relationship between structure, culture, and management practices).

Contact

Campus	Erie
Graduate Program Head	Al Warner
Program Contact	Lea Saunders l1s5443@psu.edu (814) 898-6716

People Analytics and Artificial Intelligence Graduate Credit Certificate Program

Person-in-Charge	Paul Clark
Program Code	PPLAAI
Campus(es)	University Park

In the era of digital transformation and data-driven decision-making, Human Resource professionals play a critical role in shaping organizational success. This 9-credit Graduate Certificate in People Analytics and Artificial Intelligence empowers HR practitioners with cutting-edge skills to harness the power of data and artificial intelligence for more effective talent management and strategic HR decision-making.

Courses taken in the certificate program may be applied toward a master's degree in HRER, subject to restrictions outlined in [GCAC-309 Transfer Credit](#). Certificate students who wish to have certificate courses applied towards a graduate degree in HRER must apply and be admitted to that degree program. Admission to the HRER graduate degree program is a separate step and is not guaranteed.

Effective Semester: Spring 2024
Expiration Semester: Spring 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

- Applicants with a 3.00 junior/senior grade-point average (on a 4.00 scale) will be considered for admission. Exceptions to the minimum grade-point average may be made at the discretion of the program for students with special backgrounds, abilities, and interests;
- All applicants submit a Graduate School application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) (including payment of the nonrefundable application fee), resume, and personal statement addressing their reasons for pursuing a certificate in people analytics and artificial intelligence.
- The resume and personal statement are waived if a student is currently enrolled in the MHRER or MS HRER degree programs.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

All courses must be completed with a grade of C or better and a grade-point average of 3.0 to be awarded the certificate.

Code	Title	Credits
Required Courses		
HRER 512	Research Methods and Analytics in Human Resources and Employment Relations	3
HRER 825	Strategic Business Tools for HRER Professionals	3
HRER 870	Human Resource & Employee Relations in the Age of Artificial Intelligence	3
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **Know:** Graduates will have and be able to demonstrate the necessary advanced knowledge and competence in people analytics and artificial intelligence to excel in their careers.
2. **Think:** Graduates will be able to recognize and analyze practical, legal, and ethical challenges related to people analytics and artificial intelligence issues in workplaces.
3. **Apply/Create:** Graduates will be able to conduct independent inquiries to identify current scholarship and best practices and effectively apply relevant theories and practices when solving problems in people analytics and artificial intelligence.
4. **Communicate:** Graduates will be able to effectively communicate knowledge of current topics to excel as people analytics and artificial intelligence professionals.
5. **Professional Practice:** Graduates should display behavior consistent with the highest ethical standards related to people analytics and artificial intelligence.

Contact

Campus	University Park
Graduate Program Head	Paul Clark
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Paul Clark
Program Contact	Erin Hetzel 506 Keller Building University Park PA 16802 eab27@psu.edu (814) 867-4167

Policy Analysis and Evaluation Graduate Credit Certificate Program

Person-in-Charge	Michele Tantardini
Program Code	CLPLAN
Campus(es)	Harrisburg

The primary goal of the program is to prepare policy analysts and policy/program evaluation specialists who work for governments and not-for-profit organizations for professional analytical tasks. The 12-credit curriculum is designed to educate students in the basic concepts and analytical tools of policy analysis and evaluation profession. Courses taken in the certificate program may be applied toward a Master of Public Administration (M.P.A.) degree in Public Administration (<https://bulletins.psu.edu/graduate/programs/majors/public-administration/>) at Penn State Harrisburg, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards a graduate degree in Public Administration must apply and be admitted to that degree program. Admission to the Public Administration graduate degree program is a separate step and is not guaranteed.

Effective Semester: Fall 2020

Expiration Semester: Fall 2025

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Students who are already enrolled in the M.P.A. program at Penn State Harrisburg and wish to enroll in the certificate program must complete the online Graduate School certificate application and pay the application fee just as any other certificate applicant would. They should also complete the Notice of Intent form and submit it to the program administration.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
PADM 503	Research Design	3
PADM 504	Data Analysis for Policy and Administration	3
PADM 535	Policy Analysis and Planning	3

PADM 550	Policy and Program Evaluation	3
Total Credits		12

This is a random test for text.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Contact

Campus	Harrisburg
Graduate Program Head	Michele Tantardini
Program Contact	Autumn D Wise 507 Deike Building University Park PA 16802 adw5533@psu.edu (717) 948-6773
Program Website	View (https://harrisburg.psu.edu/public-affairs/public-administration/certificate-program-policy-analysis-evaluation/)

Primary Palliative Care Graduate Credit Certificate Program

Person-in-Charge	Judith Hupcey
Program Code	PRPLCR
Campus(es)	University Park

The Penn State College of Nursing offers a Graduate Certificate in Primary Palliative Care program. The primary goal of the program is to prepare individuals with a Bachelor's or higher degree in Nursing or a related health discipline in the principles and practice of primary palliative care.

Effective Semester: Fall 2022

Expiration Semester: Fall 2027

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>) are required.

Applicants must hold a bachelor's or higher degree in nursing or a related health discipline from a U.S. regionally accredited institution or from an officially recognized degree-granting international institution.

Prior to an applicant's admission, transcripts are evaluated by the program coordinator to ascertain the applicant's potential for successful completion of the core courses. A recommendation regarding admission is discussed with the Associate Dean for Graduate Education and Research prior to making an offer of admission to this certificate program.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

The curriculum includes 6 credits (two 3 credit courses) of didactic content in primary palliative care and interdisciplinary management of advanced serious illness and one 3 credit course of the interdisciplinary practice of the palliative care role. The practicum course involves the application of knowledge acquired in previously completed courses related to primary palliative care. The practicum will build upon and extend students' previous experiences and fulfill mutually agreed-upon objectives based on the student's identified learning needs. All courses will be delivered using distance technology.

Code	Title	Credits
Required Courses		
NURS 824	Primary Palliative Care: An Interdisciplinary Approach	3
NURS 825	Primary Palliative Care: Interdisciplinary Management of Advanced Serious Illness	3
NURS 826	Interdisciplinary Practicum of the Primary Palliative Care Role	3
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Describe the fundamentals of primary palliative care for providing person-centered care to individuals with advanced serious illness and their family members including pediatric, adult, and geriatric populations.
2. Describe an interdisciplinary approach to primary palliative care.
3. Describe the interdisciplinary management of persons with advanced serious illness and their family members.
4. Demonstrate evidence-based management and communication with individuals with advanced serious illness and their family members in a healthcare setting.

5. Demonstrate the ability to work effectively in an interdisciplinary team.

Contact

Campus	University Park
Graduate Program Head	Judith E Hupcey
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Sheri Matter
Program Contact	Cassidy Shull 201 Nursing Sciences Building University Park PA 16802 crh5490@psu.edu (814) 865-0368
Program Website	View (http://www.nursing.psu.edu/graduate/)

Principalship Graduate Credit Certificate Program

Person-in-Charge	Kevin Kinser
Program Code	IPRIN
Campus(es)	University Park World Campus

The Penn State Principal Graduate Certificate is aligned with the Pennsylvania Inspired Leadership standards (PIL), as well as the standards of CAEP (Council for Accreditation of Educator Preparation) formerly known as the National Council for the Accreditation of Teacher Education (NCATE). The program has two important features:

1. A standardized Principal Graduate Certificate is offered so that all students receive a consistent, high quality, and uniform program.
2. The specific designated courses cover all national and PIL (Pennsylvania Inspired Leadership) standards. All course assignments and student results are aligned with these standards.

Effective Semester: Summer 2024

Expiration Semester: Summer 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
EDLDR 540	Technology Applications in Educational Leadership	3
EDLDR 559	School Improvement	3
EDLDR/C-S 560	Principles of Instructional Supervision	3
EDLDR 568	The Principalship	3
EDLDR 576	The Law and Education	3
EDLDR 595	Internship (Principal Internship)	3
Total Credits		18

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Professional Licensure/Certification

Many U.S. states and territories require professional licensure/certification to be employed. If you plan to pursue employment in a licensed profession after completing this program, please visit the Professional Licensure/Certification Disclosures by State (<https://www.psu.edu/state-licensure-disclosures/>) interactive map.

Contact

Campus	University Park
Graduate Program Head	Gerald K Letendre
Program Contact	Jean A McMahon 200 Rackley Bldg University Park PA 16802 jxm6462@psu.edu (814) 863-0619
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/principal-certification/overview/)
Campus	World Campus
Graduate Program Head	Gerald K Letendre
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Edward J Fuller
Program Contact	Mark Ivicic 200 Rackley Bldg University Park PA 16802 mci104@psu.edu
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/principal-certification/overview/)

Project Management Graduate Credit Certificate Program

Person-in-Charge	Jeffrey Pinto
Program Code	PMPC
Campus(es)	World Campus

Delivering complex projects on time and under budget is a daily challenge for most corporations. More organizations now use project-based methods to accomplish such tasks, resulting in increased demand for project managers. The online Graduate Certificate in Project Management is an interdisciplinary, 12-credit program that uses problem-based learning to provide a strong foundation in project management theory and practice. The program is offered by the AACSB Accredited Sam and Irene Black School of Business and Penn State is a Project Management Institute (PMI)® Registered Education Provider (R.E.P), making this certificate a well-respected credential.

In addition to being an excellent stand-alone credential, all of the courses in the Graduate Certificate in Project Management can be applied toward the Master of Project Management degree program also offered through Penn State's World Campus; however, successful completion of the certificate neither guarantees nor implies acceptance into any graduate program at Penn State. Admission to the M.P.M. graduate degree program is a separate step and is not guaranteed. Approval to apply nondegree graduate credits toward a degree program must be granted by the student's academic adviser, the program head or graduate officer, and the Graduate School. A maximum of 15 credits earned as a nondegree student may be applied to a degree program, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>).

Effective Semester: Fall 2020
Expiration Semester: Fall 2025

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Only applicants who demonstrate high promise of success for graduate work are admitted to the program. Admission decisions are based on:

1. Undergraduate grade-point average
2. A personal essay
3. Two submitted letters of recommendation

The applicant's cumulative undergraduate grade-point average or the junior/senior grade-point average is required to be a 3.0 or better.

The certificate in Project Management emphasizes application of course concepts to actual project management opportunities and problems. Therefore, students who currently are, or previously were, employed as project managers or project team members will derive the greatest

benefit from the program. All applicants must provide evidence of sufficient current or previous work experience that will enable them to successfully complete course assignments requiring the application of course concepts to real project management situations. This evidence may be provided in either the form of two letters of recommendation from individuals who know the applicant in a professional capacity or through nomination to participate in the program by an appropriate official within the applicant's employing organization. Those who write letters of recommendation or submit nominations on behalf of the applicant will be asked to attest to the nominee's suitability for the program of study considering factors such as the applicant's length of employment, level and areas of work responsibility, personal qualities, career goals, maturity of purpose, and program requirements to apply course concepts to work-related issues. Applicants are encouraged to consult with the program chair concerning the suitability of their work experiences in relationship to program requirements.

All students must be computer literate and have ready and reliable access to a computer and the Internet to successfully complete the certificate. They must know how to use word processing software, log on to an Internet provider, and use email. Additionally, students will use Microsoft Office in their course work that will require they have a working knowledge of Microsoft Office programs such as Word, Excel, Power Point, and Access. Access to fax facilities may be needed as an additional form of communication between student and instructor or between students.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Students complete MANGT 510, in their first semester of study and three additional courses for a total of 12 credits. MANGT 515 through MANGT 540 may be taken either concurrently or subsequently with MANGT 510.

Code	Title	Credits
Required Courses		
MANGT 510	Project Management	3
Select three of the following:		9
MANGT 515	Cost and Value Management	
MANGT 520	Planning and Resource Management	
MANGT 525	Commercial Law and Project Procurement	
MANGT 531	Organizations	
MANGT 535	Interpersonal and Group Behavior	
MANGT 540	Strategy: Corporate, Business and Project	
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Students will be able to analyze projects and identify key strengths and weaknesses in their organization and operation.
2. Students will comprehend the body of knowledge associated with projects and project management.
3. Students can explain the historical context in which the discipline of project management has evolved.
4. Students will be able to employ techniques that have become fundamental to the current practice of project management.
5. Students are able to integrate the broader managerial issues that have a bearing on the management of a project.
6. Students will demonstrate a "learning by doing" approach to recognizing and solving project challenges through cases and simulation.

Contact

Campus	World Campus
Graduate Program Head	Jeffrey Pinto
Program Contact	Lea Saunders 5101 Jordan Road Erie PA 16563-1400 lls5443@psu.edu (814) 898-6716
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/project-management-certificate/overview/)

Project Quality Management Graduate Credit Certificate Program

Person-in-Charge	Raghu Sangwan
Program Code	MSEPQM
Campus(es)	Great Valley World Campus

The Graduate Certificate in Project Quality Management is a program for students who aim to pursue a career in the fields of Requirements Engineering, Test Engineering and Architecture, and Project Management. Students develop knowledge and skills relevant to Requirements Engineering, Testing Strategy, Testing Infrastructure, Testing Frameworks, Testing Tools, Automated Testing, Continuous Integration, and Project Planning and Management. A certificate will be awarded upon completion of the courses.

Courses taken in the certificate program may be applied toward a master's degree in Software Engineering, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards a graduate degree must apply and be admitted to that degree program. Admission to the graduate degree program is a separate step and is not guaranteed.

Effective Semester: Spring 2024
Expiration Semester: Spring 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

1. The successful applicant is generally expected to have a minimum combined junior/senior grade-point average of 3.0 (B) on a 4.0 scale.
2. Courses taken in the certificate program may be applied toward Master of Software Engineering degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards the Master of Software Engineering must apply and be admitted to that degree program. Admission to the Master of Software Engineering graduate degree program is a separate step and is not guaranteed.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
SWENG 505	Software Project Management	3
SWENG 581	Software Testing	3
SWENG 586	Requirements Engineering	3
Total Credits		9

All courses must be completed with a minimum grade of C or better and an overall GPA of 3.0.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Work with stakeholders of a system to generate a context of use, and from it, extract needs and constraints structured into a statement of requirements.
2. Conduct testing using principles, practices and procedures for quality assurance.
3. Critically and creatively plan and manage development of software intensive systems using project management methods and tools.

Contact

Campus	Great Valley
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Raghu Sangwan
Program Contact	MICHELLE WHALEN 30 E. Swedesford Rd. Malvern PA 19355 mmw6441@psu.edu
Campus	World Campus
Graduate Program Head	Raghu Sangwan
Program Contact	MICHELLE WHALEN 30 E. Swedesford Rd. Malvern PA 19355 mmw6441@psu.edu

Psychology of Ethical Leadership Graduate Credit Certificate Program

Person-in-Charge	Greg Edward Loviscky
Program Code	PSYELD
Campus(es)	World Campus

The Psychology of Ethical Leadership Graduate Certificate will help students learn how to build ethical organizational cultures based on diversity, equity, and respect. Students will learn how to assess difficult ethical situations and dysfunctional behaviors, taking appropriate steps for preventing and resolving such situations. Lastly, students will learn how to lead collaboratively and leverage the talents of all individuals in service of ethical, principled organizations.

This certificate is offered as the second in a series of three stackable credentials building toward the M.P.S. in Psychology of Leadership. It follows the Psychology of Leadership Foundations certificate, which is the first of the stackable credentials, and precedes the third of the stackable credentials, which is for the Psychology of Team Leadership. While it is not a stand alone certificate, completing this as the second of the three stackable certificates also would provide a firm foundation with which to enter other programs with a leadership emphasis. It is intended for those early in their careers who wish to be competitive for promotions into leadership roles in the future. It also is intended for those early or midway in their careers who are in leadership roles and aspire to advance; are in ethics and compliance, leadership development, organizational effectiveness, or human resources roles; and who work directly with leaders and teams.

Effective Semester: Spring 2024

Expiration Semester: Spring 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/>)

gcac-300/gcac-305-admission-requirements-international-students/) for more information.

- Earned bachelor's degree from a regionally accredited institution
- Undergraduate cumulative GPA of 3.0 or higher
- Official transcripts from all colleges and universities attended
- At least 2 years of paid, full-time work experience
- Formatted resume' showing all work experience, education, and other experience
- One letter of recommendation from a professional contact who can speak to the applicant's leadership and other skills

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
PSY 816	Dysfunctional Leadership	3
PSY 817	Psychology of Shared and Collective Leadership	3
PSY 833	Ethics and Leadership: Psychological and Social Processes	3
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **APPLY/CREATE:** Apply psychological theories to leadership issues and situations.
2. **THINK:** Analyze leadership situations in order to evaluate leader behaviors and predict their effectiveness in self and others.
3. **PROFESSIONAL PRACTICE:** Analyze leadership situations with respect to ethics and understand the implications of leader behavior in self and others.

Contact

Campus	World Campus
Graduate Program Head	Greg Edward Lovisky
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Greg Edward Lovisky
Program Contact	Mike Joyce mjj12@psu.edu (814) 865-0704

Psychology of Leadership Foundations Graduate Certificate

Person-in-Charge	Kristin Buss
Program Code	PSLDRF
Campus(es)	World Campus

The Psychology of Leadership Foundations graduate certificate will help students learn the skills needed to motivate and empower others in organizational settings. Students will learn how to leverage the diversity of individuals' traits, strengths, skills, and abilities to build high-performing organizations. Students also will set leadership development goals for themselves and create plans for achieving them.

This certificate is offered as stand alone certificate and also as the first of the three stackable certificates building towards the M.P.S. in Psychology of Leadership. Completing it would enable enrollment in the second certificate which is the Psychology of Ethical Leadership. The certificate also would provide a firm foundation with which to enter other programs with a leadership emphasis. It is intended for those early in their careers who wish to be competitive for promotions into leadership roles in the future; and to analyze their own leadership skills and identify development opportunities. It also was intended for those early or midway in their careers who are in leadership roles and aspire to advance further; or are in leadership development, organizational effectiveness, or human resources roles that work directly with leaders.

Courses taken in the certificate program may be applied toward the M.P.S. in Psychology of Leadership, subject to restrictions outlined in GCAC-309 Transfer Credit. Certificate students who wish to have certificate courses applied towards the degree must apply and be admitted to the M.P.S. program. Admission to the M.P.S. program is a separate step and is not guaranteed.

Effective Semester: Spring 2024

Expiration Semester: Spring 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate->

admissions/how-to-apply/). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

- Earned bachelor's degree from a regionally accredited institution
- Undergraduate cumulative GPA of 3.0 or higher
- Official transcripts from all colleges and universities attended
- At least 2 years of paid, full-time work experience
- Formatted resume' showing all work experience, education, and other experience
- One letter of recommendation from a professional contact who can speak to the applicant's leadership and other skills

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

The certificate requires three courses, taken in this order:

Code	Title	Credits
Knowledge Foundations		
PSY 532	Psychological Foundations of Leadership	3
PSY 539	Foundations of Behavior, Motivation, and Attitudes at Work	3
Skills and Applications		
PSY 818	Leadership Assessment and Development	3
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **KNOW** - Graduates will be able to explain relevant theories underlying and related to the psychology of leadership.
2. **APPLY/CREATE** - Graduates will be able to apply psychological theories to leadership issues and situations.
3. **THINK** - Graduates will be able to analyze leadership situations in order to evaluate leader behaviors and predict their effectiveness in self and others.

Contact

Campus	World Campus
Graduate Program Head	Kristin Buss
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Greg Edward Lovisky
Program Contact	Mike Joyce 140 Moore Building University Park PA 16802 mjj12@psu.edu (814) 865-0704

Psychology of Team Leadership Graduate Credit Certificate Program

Person-in-Charge	Kristin Buss
Program Code	PSYTL
Campus(es)	World Campus

The Psychology of Team Leadership graduate certificate will help students learn the skills needed to motivate and empower others in organizational settings. Students also will learn how to be effective leaders of or members of teams that can collaborate to achieve common goals. Lastly, students will learn how to make sound decisions about organizational problems with confidence and without bias.

This certificate is offered as the third in a series of three stackable credentials building toward the MPS in Psychology of Leadership. Students using this stackable plan should complete the Psychology of Leadership Foundations Graduate Credit Certificate followed by the Psychology of Ethical Leadership Graduate Credit Certificate and have entered the degree program before pursuing this certificate.

The certificate is also offered as a standalone program and provides a firm foundation with which to enter other programs with a leadership emphasis. It is intended for those early in their careers who wish to become more effective team members; and be competitive for promotions into leadership roles in the future. It also is intended for those early or midway in their careers who are in leadership roles and aspire to advance further; and are in leadership development, organizational effectiveness, or human resources roles that work directly with leaders and teams.

Courses taken in the certificate program may be applied toward the MPS in Psychology of Leadership, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards the degree must apply and be admitted to the M.P.S. program. Admission to the M.P.S. program is a separate step and is not guaranteed.

Effective Semester: Spring 2024

Expiration Semester: Spring 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

- Earned bachelor's degree from a regionally accredited institution
- Undergraduate cumulative GPA of 3.0 or higher
- Official transcripts from all colleges and universities attended
- At least 2 years of paid, full-time work experience
- Formatted resume' showing all work experience, education, and other experience
- One letter of recommendation from a professional contact who can speak to the applicant's leadership and other skills

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
PSY 812	Group Leadership and Effective Decision Making	3
PSY 814	Psychology of Leading Work Groups and Teams	3

2 additional courses selected in consultation with the student's adviser.	6
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Total Credits	12
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Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **APPLY/CREATE** - Graduates will be able to apply psychological theories to leadership issues and situations.
2. **KNOW, COMMUNICATE** - Graduates will be able to synthesize theories to communicate a comprehensive understanding of the psychology of leadership.
3. **APPLY/CREATE, THINK** - Graduates will be able to analyze leadership situations in order to evaluate leader behaviors and predict their effectiveness in self and others.
4. **COMMUNICATE, THINK, PROFESSIONAL PRACTICE** - Graduates will be able to plan strategies for improving leadership and organizational effectiveness.

Contact

Campus	World Campus
Graduate Program Head	Kristin Buss
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Greg Edward Loviscky
Program Contact	Mike Joyce mjj12@psu.edu (814) 865-0704

Public Budgeting and Financial Management Graduate Credit Certificate Program

Person-in-Charge	Odd Stalebrink
Program Code	CLPFIN
Campus(es)	Harrisburg World Campus

The primary goal of this graduate certificate is to educate administrators and professionals in government and not-for-profit organizations who need to acquire additional knowledge and skills in the following areas:

1. fiscal and governmental aspects of budgeting and financial management;
2. development of organizational budgets; and
3. governmental and not-for-profit accounting.

At the end of the program students will be able to:

- Explain the significance of key topics in government financial management (governmental accounting, auditing, financial reporting,

internal controls and budgeting at the federal, state and local levels) as they relate to public sector organizations.

- Describe how government financial management can contribute toward more efficient use of public resources, increased transparency and improved accountability.
- Identify and describe the role of key actors in the government financial management process.
- Apply key financial management planning, management, and control tools to addressing resource constraints, and meeting transparency and accountability demands.

Effective Semester: Summer 2022

Expiration Semester: Summer 2027

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

To complete the program students need to successfully complete 9 credits. Successful completion of a course is defined as a grade of B- or better.

Code	Title	Credits
Prescribed Courses		
PADM 502	Governmental Fiscal Decision Making	3
PADM 522	Government Financial Management	3
PADM 523	Governmental and Nonprofit Accounting	3
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **Explain, clearly articulate and communicate** the significance of key topics in government financial management (governmental accounting, auditing, financial reporting, internal controls and budgeting at the federal, state and local levels) as they relate to public sector organizations.

2. **Describe** how government financial management can contribute toward more efficient use of public resources, increased transparency and improved accountability.
3. **Identify** and describe the role of key actors in the government financial management process.
4. **Apply** key financial management planning, management, and control tools to addressing resource constraints, and meeting transparency and accountability demands.

Contact

Campus	Harrisburg
Graduate Program Head	Odd Jonas Stalebrink
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Younhee Kim

Program Contact	Autumn D Wise 777 West Harrisburg Pike Middletown PA 17057 adw5533@psu.edu (717) 948-6773
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Program Website	View (https://harrisburg.psu.edu/public-affairs/public-administration/certificate-program-public-budgeting-and-financial-management/)
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Campus	World Campus
Graduate Program Head	Odd Jonas Stalebrink
Program Contact	Autumn D Wise 777 West Harrisburg Pike Penn State Harrisburg Middletown PA 17057 adw5533@psu.edu (717) 948-6773

Program Website	View (https://www.worldcampus.psu.edu/degrees-and-certificates/public-budgeting-financial-management-certificate/overview/)
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Public Health Graduate Credit Certificate Program

Graduate Program Head	Cheryl Thompson
Program Code	HYGC PH
Campus(es)	Hershey

The purpose of the graduate certificate in Public Health is to provide students with foundational graduate-level course work in public health. Upon completion of the Public Health certificate, students will be able to:

1. Demonstrate their knowledge in core areas of public health, which include biostatistics, epidemiology, health services administration, and social and behavioral sciences.
2. Apply their knowledge and skills to solving public health problems.

All courses in the certificate program may be applied to the M.P.H. degree program, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>). Students must earn a grade of B or better for a course

to be applied to the M.P.H. degree program. Certificate program students who wish to have the certificate courses applied to the M.P.H. degree program must formally apply and be admitted to the Penn State M.P.H. degree program. Admission into the Penn State M.P.H. degree program is a separate step and is not guaranteed.

Effective Semester: Summer 2023

Expiration Semester: Summer 2028

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Applicants must submit the following items with their applicant for admission to the Public Health certificate program:

- Official transcripts from all post-secondary institutions attended (<http://gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>)
- Resume/CV
- Statement of Purpose or Rationale for seeking a Graduate Certificate in Public Health
- Two letters of recommendation

Upon approval, certificate program students will enroll in course work on a nondegree basis. Note that admission as a nondegree graduate student neither guarantees nor implies subsequent admission to a degree program. Nondegree students are not eligible to receive fellowships or graduate assistantships.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Students must complete each course with a grade of B or better in order to receive the certificate.

Code	Title	Credits
Required Courses		
PHS 504	Behavioral Health Intervention Strategies	3
PHS 520	Principles of Biostatistics	3
PHS 550	Principles of Epidemiology	3
PHS 571	Health Services Organization and Delivery	3
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by

graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

Evidence-based Approaches to Public Health

- Apply epidemiological methods to the breadth of settings and situations in public health practice.
- Select quantitative and qualitative data collection methods appropriate for a given public health context.
- Analyze quantitative and qualitative data using biostatistics, informatics, computer-based programming and software, as appropriate.
- Interpret results of data analysis for public health research, policy or practice.

Public Health & Health Care Systems

- Compare the organization, structure and function of health care, public health and regulatory systems across national and international settings.

Planning & Management to Promote Health.

- Assess population needs, assets and capacities that affect communities' health.
- Apply awareness of cultural values and practices to the design or implementation of public health policies or programs.
- Select methods to evaluate public health programs.

Policy in Public Health

- Discuss multiple dimensions of the policy-making process, including the roles of ethics and evidence.
- Propose strategies to identify stakeholders and build coalitions and partnerships for influencing public health outcomes.
- Advocate for political, social or economic policies and programs that will improve health in diverse populations.
- Evaluate policies for their impact on public health and health equity.

Communication

- Select communication strategies for different audiences and sectors.
- Communicate audience-appropriate public health content, both in writing and through oral presentation.
- Describe the importance of cultural competence in communicating public health content.

Systems Thinking

- Apply systems thinking tools to a public health issue.

Contact

Campus	Hershey Med Ctr
Graduate Program Head	Cheryl Thompson
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Wenke Hwang
Program Contact	Carol Quigley Laregina Dept of Public Health Sciences, A210 90 Hope Dr, Suite 2200 Hershey PA 17033 cxl58@psu.edu (717) 531-6280
Program Website	View (http://med.psu.edu/public-health-certificate/)

Public Health Preparedness Graduate Credit Certificate Program

Person-in-Charge	Eugene J. Lengerich
Program Code	PHPGC
Campus(es)	World Campus

This graduate certificate program is designed to provide non-science students with broad training in the field of public health preparedness. A distance education format is used to accommodate the needs of professionals already active in this area.

Effective Semester: Summer 2019

Expiration Semester: Summer 2024

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

All applicants are required to submit a resume, statement of purpose, 3 letters of recommendation, and GRE scores. Applicants may request a waiver from the GRE requirement if they meet one of the following criteria:

- 3.00 undergraduate grade-point average (GPA) either overall or in the last 60 credits;
- 5+ years of professional work experience;
- 3.00 GPA upon completion of a graduate certificate; or
- successful completion of a graduate or professional degree.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/>).

[gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/](https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/)).

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Students must complete each course with a grade of B or better in order to receive the certificate.

Code	Title	Credits
Required Courses		
PHS 504	Behavioral Health Intervention Strategies	3
PHS 520	Principles of Biostatistics	3
PHS 550	Principles of Epidemiology	3
PHS 571	Health Services Organization and Delivery	3
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **PHP ORG:** Students will be able to identify major organizations, agencies, and policies that substantially affect the practice of public health preparedness.
2. **PHP APP:** Students will be able to identify, design, implement, and evaluate evidence-based approaches to public health preparedness.
3. **PHP EPI:** Students will be able to apply basic epidemiologic principles and methods to public health preparedness.
4. **PHP HOSP ERP:** Students will be able identify and evaluate hospital vulnerabilities and to develop a hospital emergency response plan.
5. **PHP LEAD/TEAM:** Students will demonstrate effective leadership and team-based practices and procedures.

Contact

Campus	World Campus
Graduate Program Head	Eugene Joseph Lengerich
Program Contact	Rachel Marie Reager Office of Graduate Education 500 University Dr., MC H170 Hershey PA 17033 rmr16@psu.edu (717) 531-8892
Program Website	View (http://www.worldcampus.psu.edu/degrees-and-certificates/homeland-security-public-health-preparedness/overview/)

Public Sector Human Resources Management Graduate Credit Certificate Program

Person-in-Charge	Bing Ran
Program Code	CLPHR
Campus(es)	Harrisburg World Campus

The graduate credit certificate program in Public Sector Human Resources Management is offered by the Public Administration program at Penn State Harrisburg.

The certificate is designed for administrators and other professionals in government and not-for-profit organizations who need to acquire additional knowledge and skills in the following areas:

- personnel/human resource management
- labor relations
- problem solving
- planning
- management of organizational change and development

Effective Semester: Summer 2022

Expiration Semester: Summer 2027

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

A Graduate School application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) must be completed and official transcripts from all post-secondary institutions attended (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission/>) must be submitted.

Successful applicants typically have a 3.0 grade-point average in the last two years of undergraduate work.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

The certificate program in Public Sector Human Resources Management requires taking four courses (12 credits) – two required and two elective courses.

Applicants who have graduate degrees in public administration or a related field, and who have taken graduate courses that duplicate the

content of courses in the certificate program, may substitute other PADM courses for those courses with the prior approval of the person in charge. Graduate transcripts, course syllabus, and course projects/term papers will be needed for this evaluation process.

Some certificate courses may be used toward completion of the master's degrees in Public Administration and in Health Administration, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>). Certificate students who wish to have certificate courses applied towards a graduate degree must apply and be admitted to that degree program. Admission to the M.P.A. or M.H.A. graduate degree program is a separate step and is not guaranteed.

Code	Title	Credits
Required Courses		
PADM 505	Human Resources in the Public and Nonprofit Sectors	3
PADM 510	Organization Behavior	3
Electives		
Choose 2 courses from the following list of elective courses. With the approval by the certificate coordinator, students could also choose other HR-related Penn State graduate-level courses as elective courses for this certificate.		
PADM 511	Organizational Change and Development	6
PADM 516	Strategic Planning	
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Explain and apply the knowledge and skills needed to effectively manage human resources in modern organizations.
2. Explain and apply knowledge of human behavior in organizations and the role of management strategies, including leadership and motivational theory to influence behavior.
3. Explain and apply knowledge of the critical personnel management functions, such as recruitment, selection, appraisal, compensation, training, promotion, downsizing, and collective bargaining.
4. Analyze and appraise contemporary issues as they relate to human resources.

Contact

Campus	Harrisburg
Graduate Program Head	Bing Ran
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Younhee Kim
Program Contact	Autumn D Wise School of Public Affairs 777 W. Harrisburg Pike Middletown PA 17057 adw5533@psu.edu (717) 948-6773
Program Website	View (https://harrisburg.psu.edu/public-affairs/public-administration/certificate-program-public-sector-human-resource-management/)
Campus	World Campus
Graduate Program Head	Bing Ran
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Younhee Kim
Program Contact	Autumn D Wise School of Public Affairs 777 W. Harrisburg Pike Middletown PA 17057 adw5533@psu.edu (717) 948-6773
Program Website	View (https://www.worldcampus.psu.edu/degrees-and-certificates/public-sector-human-resources-management-certificate/overview/)

Quality Management Across Product Lifecycle Graduate Credit Certificate Program

Person-in-Charge	Raghu Sangwan
Program Code	MEMQM
Campus(es)	Great Valley World Campus

The Graduate Certificate in Quality Management Across Product Lifecycle is a program for students who aim to pursue a career as Quality Assurance Engineer/Manager, Process Engineering Manager, Test Engineer/Manager, or Project Manager where skills will include responsibilities in oversight of maintaining quality standards within a technical organization, overseeing teams responsible for implementation of manufacturing processes and equipment, design and implement test strategies to ensure product quality, or plan management of technical project from start to finish.

Courses taken in the certificate program may be applied toward a master's degree in Engineering Management, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards a graduate degree must apply and be admitted to that degree program.

Admission to the graduate degree program is a separate step and is not guaranteed.

Effective Semester: Spring 2024

Expiration Semester: Spring 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

1. The successful applicant is generally expected to have a minimum combined junior/senior grade-point average of 3.0 (B) on a 4.0 scale.
2. Courses taken in the certificate program may be applied toward Master of Engineering Management degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards the Master of Engineering Management must apply and be admitted to that degree program. Admission to the Master of Engineering Management graduate degree program is a separate step and is not guaranteed.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
ENGMT 841	Application of Statistics in Quality and Continuous Improvement in Engineering	3
STAT 500	Applied Statistics	3
SYSEN 530	Systems Optimization	3
Total Credits		9

All courses must be completed with a minimum grade of C or better and an overall GPA of 3.0.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **APPLY/CREATE** - Demonstrate continuous improvement of the process, product, and performance as applied to technical projects.

2. **APPLY/CREATE** - Develop capabilities with appropriate and meaningful data and use statistical and optimization tools for proper decision making.

Contact

Campus	Great Valley
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Nil Hande Ergin
Program Contact	MICHELLE WHALEN 30 E. Swedesford Rd. Malvern PA 19355 mmw6441@psu.edu
Campus	World Campus
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Nil Hande Ergin
Program Contact	MICHELLE WHALEN 30 E. Swedesford Rd. Malvern PA 19355 mmw6441@psu.edu

Quantitative Business Essentials Graduate Credit Certificate Program

Person-in-Charge	Zugang Liu
Program Code	QBUSE
Campus(es)	Great Valley

The Graduate Certificate in Quantitative Business Essentials provides students with the knowledge and skills necessary to become more efficient and effective managers and decision-makers. For students without a formal business education, this program equips them with fundamental concepts in data-driven decision making, accounting, finance, and supply chain management. For students with some business background, such as marketing, the program offers an excellent opportunity to upgrade their skills with essential tools of business.

The program emphasizes the role of the decision maker who is in a position of evaluating alternatives to make a sound and profitable business choice. Upon completion, students will be conversant in utilizing appropriate statistical techniques and interpreting reports for various business scenarios, be able to assess the financial standing of a company from its financial statements, calculate and evaluate the cost of capital for a project, evaluate the risk and return trade-off in various business decisions, and optimize their supply chain and logistics operations. These skills can be applied to any current business or to assess the feasibility of a proposed start-up.

Effective Semester: Fall 2023
Expiration Semester: Fall 2028

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International

applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

The successful applicant is generally expected to have a minimum combined junior/senior grade-point average of 3.0 (B) on a 4.0 scale.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

To be awarded the graduate certificate, students must successfully complete 9 credits of course work consisting of 6 required credits and 3 elective credits. All courses must be completed with a minimum grade of C or better and an overall GPA of 3.0.

Code	Title	Credits
Required Courses		
BUS 510	Business Analytics and Decision Modeling	3
ACCTG 800	Financial and Managerial Accounting	3
Choose 1 of the following courses:		
MBADM 820	Financial Management	3
BA 810	Supply Chain and Operations Management	
BUSAD 811	New Ventures Ideation and Feasibility Analysis	
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

- Students will be able to analyze an organization's financial statements and compare to industry and key competitors.
- Students will have improved skills needed for new ventures including: presentation, negotiation, interviewing, and self-awareness skills.

Contact

Campus	Great Valley
Graduate Program Head	Zugang Liu
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Sagnika Sen
Program Contact	DENISE Y. SMITH 30 E Swedesford Road Malvern PA 19355 dms7338@psu.edu (610) 648-3336
Program Website	View (https://greatvalley.psu.edu/academics/graduate-certificates/quantitative-business-essentials/)

Quantitative Decision Making for Engineering Managers Graduate Credit Certificate Program

Person-in-Charge	Raghu Sangwan
Program Code	MEMQDM
Campus(es)	Great Valley World Campus

The Graduate Certificate in Quantitative Decision Making for Engineering Managers is a program for students who aim to pursue a career as a Product Manager, Operations Manager, or Production Manager where skills will include responsibilities in product, service, and process development and analysis, strategic planning and management, technical and data driven decision making, risk analysis, decision models, technology assessment, engineering economics analysis, or financial resource management.

Courses taken in the certificate program may be applied toward a master's degree in Engineering Management, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards a graduate degree must apply and be admitted to that degree program. Admission to the graduate degree program is a separate step and is not guaranteed.

Effective Semester: Spring 2024
Expiration Semester: Spring 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

1. The successful applicant is generally expected to have a minimum combined junior/senior grade-point average of 3.0 (B) on a 4.0 scale.

2. Courses taken in the certificate program may be applied toward Master of Engineering Management degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards the Master of Engineering Management must apply and be admitted to that degree program. Admission to the Master of Engineering Management graduate degree program is a separate step and is not guaranteed.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
ENGMT 501	Engineering Management Science	3
ENGMT 510	Economics and Financial Studies for Engineers	3
SYSEN 536	Decision and Risk Analysis in Engineering	3
Total Credits		9

All courses must be completed with a minimum grade of C or better and an overall GPA of 3.0.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **APPLY/CREATE:** Demonstrate knowledge of foundational principles of project operations including forecasting, simulation, inventory management and critical path analysis
2. **THINK:** Evaluate the financial aspects and estimate risk and their impact on the decision-making process as applied to the technical project management

Contact

Campus	Great Valley
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Nil Hande Ergin
Program Contact	MICHELLE WHALEN 30 E. Swedesford Rd Malvern PA 19355 mmw6441@psu.edu

Campus	World Campus
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Nil Hande Ergin
Program Contact	MICHELLE WHALEN 30 E. Swedesford Rd Malvern PA 19355 mmw6441@psu.edu

Real Estate Law and Valuation Graduate Credit Certificate Program

Person-in-Charge	Brent Ambrose
Program Code	RELWVL
Campus(es)	World Campus

The Graduate Certificate in Real Estate Law and Valuation is offered by the Smeal College of Business. Several areas of law intersect with real property (i.e. taxation, family law, estate planning, litigation, corporate practice, etc). By obtaining the knowledge and skills within this graduate certificate, students will be able to successfully navigate legal challenges within real property, understand valuation and feel comfortable negotiating real estate deals. This program will also provide business managers with the tools and skills necessary to interact with the real estate industry to efficiently utilize their firms' real estate assets. The graduate certificate is a 9-credit program that can be completed in one calendar year.

Effective Semester: Summer 2022

Expiration Semester: Summer 2027

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Other admissions requirements include:

- Official Transcripts – Submit official transcripts from all post-secondary institutions attended, regardless of the number of credits or semesters completed. Transcripts not in English must be accompanied by a certified translation.
- Statement of Purpose – Applicants must describe how professional experience and goals align with the Certificate in Real Estate Law and Valuation, not to exceed 500 words.
- Vita or Résumé – Provide a one- to two-page listing of professional experience and education.

GRE/GMAT scores are NOT required.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate

Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
REST 830	Real Estate Institutions and Markets Analysis	1
REST 832	Real Estate Negotiations	2
RM 424	Real Estate Law	3
REST 885	Real Estate and Business Valuation	3
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

- Graduates will be able to demonstrate competency in the foundational concepts and practices required for real estate valuation.
- Graduates will master a broad core of legal and economic knowledge and be able to integrate and apply this knowledge to business situations within the real estate industry

Contact

Campus	World Campus
Graduate Program Head	Brent William Ambrose
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Brent William Ambrose
Program Contact	Michelle Kristen Rockower mkk114@psu.edu (814) 865-5290
Program Website	View (https://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-real-estate-law-and-valuation-graduate-certificate/overview/)

Remote Sensing and Earth Observation Graduate Credit Certificate Program

Person-in-Charge	Karen Schuckman
Program Code	RMTSNG
Campus(es)	World Campus

The Certificate in Remote Sensing and Earth Observation helps geospatial professionals become skillful users of imagery and sensor data in the context of geographic information systems and spatial analysis. This program is designed specifically for GIS practitioners who

lack formal education in techniques and technologies associated with spatial image analysis and earth observation methods in order to help them pursue professional development goals. The program engages key theories, current research, and contemporary techniques for the professional application of remote sensing in geospatial systems and analysis.

Effective Semester: Summer 2021

Expiration Semester: Summer 2026

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Intermediate-level experience with professional applications of geographic information systems is expected as pre-requisite knowledge. Coursework to establish that pre-requisite knowledge is available through the related Postbaccalaureate Certificate in GIS program (<https://bulletins.psu.edu/graduate/programs/certificates/geographic-information-systems-postbaccalaureate-credit-certificate-program/>).

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Students earn the certificate by completing four instructor-led online courses – three required and one elective. Students who successfully complete the program earn 12 academic credits.

Students admitted to the Department of Geography's Master of GIS degree program may count up to 15 credits of certificate program courses toward the M.G.I.S. degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards a graduate degree must apply and be admitted to that degree program. Admission to the M.G.I.S. graduate degree program is a separate step and is not guaranteed.

Code	Title	Credits
Prescribed Courses		
GEOG 480	Exploring Imagery and Elevation Data in GIS Applications	3
GEOG 883	Remote Sensing Image Analysis and Applications	3
GEOG 481	Topographic Mapping with Lidar	3
Electives		
GEOG 589 or GEOG 892	Emerging Trends in Remote Sensing Geospatial Applications of Unmanned Aerial Systems	3
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

Application

- Apply knowledge of various remote sensing technologies and platforms for the creation of spatial information to address challenges in the private, commercial, and societal sectors.

Communication

- Communicate the nuances of complex spatial relationships with text, voice, and visual products to broadly inform professional and non-technical audiences in a range of contexts.

Creation

- Create innovative solutions by collecting remotely sensed observations to create new knowledge as exemplified in maps and databases to generate solutions to challenging problems.

Critical Thinking

- Objectively analyze and evaluate a situation in the context of available remotely sensed observations in support of further analysis, problem solving, and decision making.

Cultural Competence

- Demonstrate knowledge of cultural norms that are respectful of diversity and inclusion to establish a positive and professional work environment.

Ethics

- Demonstrate ethical conduct by producing quality work, contributing to the community, managing professional relationships by establishing honest and respectful interactions among individuals and organizations.

Knowledge

- Apply knowledge of remotely sensed information using appropriate geographic information technologies in a variety of contexts to educate, solve problems and make decisions.

Professional

- Demonstrate conduct in alignment with professional standards in interpersonal communication, mediation, and respect for diversity while recognizing appropriate team roles in professional, community and education-based activities.

Research

- Combine accepted techniques and prior knowledge of remote sensing technologies to create new solutions for previously unencountered situations.

Contact

Campus	World Campus
Graduate Program Head	Karen Lee Schuckman
Program Contact	Julene A Santiago 418 Earth Engr Sciences University Park PA 16802 jas9616@psu.edu (814) 865-2557
Program Website	View (https://gis.education.psu.edu/remotesensing/certificate/)

Sensory and Consumer Science Graduate Credit Certificate Program

Person-in-Charge	Helene Hopfer
Program Code	SNCNSC
Campus(es)	University Park World Campus

The primary goal of this graduate certificate program is to provide formal education to sensory and consumer professionals in the key areas of (i) psychophysical and biological principles and human behavior as it guides and informs sensory and consumer testing, (ii) fundamentals of good sensory practice including experimental design, method selection, analysis, and reporting, (iii) applied statistics and data analysis as used in sensory and consumer science, and (iv) the interaction of sensory and consumer science with marketing, consumer understanding, product development, and business.

The 12-credit curriculum integrates all these aspects in a synergistic manner.

Effective Semester: Fall 2019

Expiration Semester: Fall 2024

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

All individuals wishing to pursue a graduate certificate program, even those already enrolled as a graduate degree student, must apply and be admitted using the Graduate School's online application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>). Applicants

need to demonstrate successful completion of undergraduate level statistics (STAT 200 or equivalent).

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
STAT 500	Applied Statistics	3
FDSC 403	Sensory Data Collection & Analysis	3
FDSC 515	Sensometrics - Applied Multivariate Analysis in Sensory & Food Science	3
FDSC 516	Consumer Insights	3
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Contact

Campus	University Park
Graduate Program Head	Helene Hopfer
Program Contact	Helene Hopfer 202 Erickson Food Science Building University Park PA 16802 hxh83@psu.edu (814) 863-5572
Program Website	View (https://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-sensory-and-consumer-science-certificate/overview/)

Campus	World Campus
Graduate Program Head	Helene Hopfer
Program Contact	Helene Hopfer 202 Erickson Food Science Building University Park PA 16802 hxh83@psu.edu (814) 863-5572
Program Website	View (https://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-sensory-and-consumer-science-certificate/overview/)

Software Architecture and Design Graduate Credit Certificate Program

Person-in-Charge	Raghu Sangwan
Program Code	MSESAD
Campus(es)	Great Valley World Campus

The Graduate Certificate in Software Architecture and Design is a program for students who aim to pursue a career that includes competencies for creating large-scale software intensive systems. Students develop knowledge and skills relevant to analyzing, architecting, designing, implementing and managing the technical development aspects of a software system. A certificate will be awarded upon completion of the courses.

Courses taken in the certificate program may be applied toward a master's degree in Software Engineering, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards a graduate degree must apply and be admitted to that degree program. Admission to the graduate degree program is a separate step and is not guaranteed.

Effective Semester: Spring 2024

Expiration Semester: Spring 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

1. The successful applicant is generally expected to have a minimum combined junior/senior grade-point average of 3.0 (B) on a 4.0 scale.
2. Courses taken in the certificate program may be applied toward Master of Software Engineering degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards the Master of Software Engineering must apply and be admitted to that degree program. Admission to the Master of Software Engineering graduate degree program is a separate step and is not guaranteed.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
SWENG 587	Software Systems Architecture	3
SWENG 837	Software System Design	3
SWENG 861	Software Construction	3
Total Credits		9

All courses must be completed with a minimum grade of C or better and an overall GPA of 3.0.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Upon completion of the certificate, students will be able to architect, design, and implement software systems along with the configuration management, continuous integration and deployment.

Contact

Campus	Great Valley
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Raghu Sangwan
Program Contact	MICHELLE WHALEN 30 E. Swedesford Rd. Malvern PA 19355 mmw6441@psu.edu
Campus	World Campus
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Raghu Sangwan
Program Contact	MICHELLE WHALEN 30 E. Swedesford Rd. Malvern PA 19355 mmw6441@psu.edu

Solar Energy Graduate Credit Certificate Program

Person-in-Charge	Mark Fedkin
Program Code	SOLEGY
Campus(es)	World Campus

The graduate certificate in Solar Energy is designed for current and aspiring practitioners seeking advanced skills in resource assessment, project development, and system design for solar energy systems. The program is offered by the Department of Energy and Mineral Engineering through Penn State's World Campus.

Courses taken in the certificate program may be applied toward the Master of Professional Studies in Renewable Energy and Sustainability

Systems (RESS) if the student has earned a B- or better in each course, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>). Certificate students who wish to have certificate courses applied towards the M.P.S. in RESS must apply and be admitted to that degree program. Admission to the RESS graduate degree program is a separate step and is not guaranteed.

Effective Semester: Fall 2023

Expiration Semester: Fall 2028

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

A background in engineering, physics, or systems science is strongly recommended.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Certificate students earn the Certificate and 12 graduate credits by successfully completing each of four 3-credit, instructor-led online courses with a grade of C or better.

Code	Title	Credits
Required Courses		
EME 810	Solar Resource Assessment and Economics	3
AE 878	Solar Project Development and Finance	3
Electives		
Select 6 credits from the following:		6
EME 812	Utility Solar Power and Concentration	
AE 868	Commercial Solar Electric Systems	
EME 811	Solar Thermal Energy for Utilities and Industry	
AE 862	Distributed Energy Planning and Management	
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Evaluate solar energy systems using techno-economic, performance and/or cost/benefit analyses, including multi-parameter dynamic simulation tools.
2. Demonstrate fundamental understanding of the principles of solar energy science, including resource availability, resource intermittency, and options for solar energy conversion systems.
3. Demonstrate an appreciation for the project development and stakeholder engagement process relative to the goal of solar design: identifying stakeholder preference for solar goods and services in a given locale.
4. Evaluate project development and/or sustainability decisions in the broader context of society's interests.

Contact

Campus	World Campus
Graduate Program Head	Mark Valentinovich Fedkin
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Mark Valentinovich Fedkin
Program Contact	Noelle Fetzer Capparelle 2217 Earth Engr Sciences University Park PA 16802 nlf5@psu.edu (814) 867-5401
Program Website	View (https://www.ress.psu.edu/node/14/)

Strategic Human Resources and Workplace Ethics Graduate Credit Certificate

Person-in-Charge	Paul Clark
Program Code	SHRWET
Campus(es)	University Park World Campus

This 9-credit program is designed to equip professionals with the knowledge and skills needed to excel in HR leadership roles by focusing on the strategic aspects of HR management and the ethical considerations that underpin this critical function.

Courses taken in the certificate program may be applied toward a master's degree in HRER, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards a graduate degree in HRER must apply and be admitted to that degree program. Admission to the HRER graduate degree program is a separate step and is not guaranteed.

Effective Semester: Spring 2024

Expiration Semester: Spring 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies

(<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

- Applicants with a 3.00 junior/senior grade-point average (on a 4.00 scale) will be considered for admission. Exceptions to the minimum grade-point average may be made at the discretion of the program for students with special backgrounds, abilities, and interests;
- #All applicants submit a Graduate School application (including payment of the nonrefundable application fee), resume, and personal statement addressing their reasons for pursuing a certificate in strategic human resources and workplace ethics;
- The resume and personal statement are waived if a student is currently enrolled in the MHRER or MS HRER degree programs.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

All courses must be completed with a grade of C or better and a grade-point average of 3.0 to be awarded the certificate.

Code	Title	Credits
Required Courses		
HRER 512	Research Methods and Analytics in Human Resources and Employment Relations	3
HRER 825	Strategic Business Tools for HRER Professionals	3
<i>Choose 3 credits from the following list.</i>		
LHR 499	Foreign Studies	3
HRER 500	Topics in Comparative Industrial Relations	
HRER 503	Seminar in International Human Resources Studies	
HRER 803	Human Resources in Multinational Enterprises	
HRER 865	Diversity and Ethics in the Workplace	
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **Know:** Graduates will have and be able to demonstrate the necessary advanced knowledge and competence in strategic human resources and workplace ethics to excel in their careers.
2. **Think:** Graduates will be able to recognize and analyze practical, legal, and ethical challenges related to strategic human resources and workplace ethics issues in workplaces.

3. **Apply/Create:** Graduates will be able to conduct independent inquiries to identify current scholarship and best practices and effectively apply relevant theories and practices when solving problems related to strategic human resources and workplace ethics.
4. **Communicate:** Graduates will be able to effectively communicate knowledge of current topics to excel as professionals in strategic human resources and workplace ethics.
5. **Professional Practice:** Graduates should display behavior consistent with the highest standards related to strategic human resources and workplace ethics.

Contact

Campus	University Park
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Brian Francis Redmond
Program Contact	Erin Hetzel 506 Keller Building University Park PA 16802 eab27@psu.edu (814) 867-4167

Campus	World Campus
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Brian Francis Redmond
Program Contact	Erin Hetzel eab27@psu.edu (814) 867-4167

Strategic Leadership Graduate Credit Certificate Program

Person-in-Charge	Vilmos Misangyi
Program Code	SMEXL
Campus(es)	World Campus

The graduate certificate in Strategic Leadership is a 12-credit program designed to be an engaging, practical and comprehensive program that helps seasoned professionals learn how to formulate compelling strategies, align organizational elements in the pursuit of those strategies, and build culture and commitment across an organization. With core course work in Strategic Leadership, Strategy Formulation and Implementation, Strategic Management, and Leadership and Identity, experienced professionals gain the solid foundation needed in leadership positions.

Course content focuses on: managerial challenges of strategy implementation; ability to think strategically about organizational issues and challenges, develop effective strategies for organizational performance and success, and shape organizational cultures that facilitate strategy implementation and organizational change, the ethical and societal implications of managerial decisions, as well as an exploration of unique approaches to strategic leadership that emphasize identity issues that are critical to understanding individual and collective processes in organizational life.

Effective Semester: Fall 2024
Expiration Semester: Fall 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Exceptions to GCAC-305 (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) will be considered by the program. Exceptions may or may not be granted by the Graduate School.

Other admissions requirements include:

- **Application** – Complete a Graduate School application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) for graduate study including nonrefundable application fee.
- **Statement of Purpose** – Submit a statement describing how professional experience and goals align with the certificate.
- **Vita or Résumé** – Provide a one- to two-page listing of professional experience and education.
- **Approximately five years of relevant work and management experience preferred.**

GRE/GMAT scores are NOT required.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
MBADM 571	Global Strategic Management	3
BA 888	Executive Leadership	3
MGMT 831	Strategy Implementation and Organizational Change	3
BA 865	Strategic Leadership	3
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

- Understand how to formulate, implement, and evaluate a strategy for a global firm

- Develop a framework for leading the change process
- Demonstrate knowledge of fundamental topics, theories, concepts, and frameworks in strategic management
- Understand how to identify areas for personal development in leadership style
- Understand how to identify the progressive leadership skills needed at varying organizational levels
- Understand business cycles and organizational culture

Contact

Campus	World Campus
Graduate Program Head	Vilmos Misangyi
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Albert Vicere
Program Contact	Michelle Kristen Rockower mkk114@psu.edu (814) 865-5290
Program Website	View (https://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-strategic-management-and-executive-leadership-certificate/overview/)

Superintendency Graduate Credit Certificate Program

Person-in-Charge	David Gamson
Program Code	SUPER
Campus(es)	University Park

The Letter of Eligibility (LOE) program is a residential program offered at University Park and has three important features:

The Education Leadership program has received approval from the Pennsylvania Department of Education (PDE) for the courses and course sequence that lead to the PDE Superintendent Letter of Eligibility (LOE). This graduate certificate consists of the required credits for the PDE Superintendent Letter of Eligibility and will provide an additional credential for students who complete these credit requirements. The PDE Superintendent Letter of Eligibility (LOE) has additional requirements that need to be fulfilled in order for it to be awarded; contact the College of Education's Advising & Certification Center for more information.

The Penn State courses for the Letter of Eligibility (LOE) for the Superintendent/Assistant Superintendent/Intermediate Unit Director have been evaluated by Council for the Accreditation of Educator Preparation (CAEP) and The National Educational Leadership Preparation (NELP) standards. These preparation standards, formerly known as the Educational Leadership Constituent Council (ELCC) standards, have been renamed the National Educational Leadership Preparation (NELP) standards.

There are two options for obtaining the LOE: (a) for students in an Ed.D. or Ph.D. program, by pursuing the LOE as part of their doctoral coursework, or (b) for candidates only interested in pursuing the LOE, through the completion of the required 21 credits, the successful completion of the internship, and the receipt of a passing score on the Pennsylvania state mandated assessment.

Effective Semester: Spring 2021
Expiration Semester: Spring 2026

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

The PDE Superintendent Letter of Eligibility (LOE) has additional admission requirements; contact the College of Education’s Advising & Certification Center for more information.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

To be awarded the Superintendency Graduate Certificate, students must successfully complete 21 credits of course work in the required courses listed below. The PDE Superintendent Letter of Eligibility (LOE) has additional requirements that need to be fulfilled in order for it to be awarded; contact the College of Education’s Advising & Certification Center for more information.

Code	Title	Credits
Required Courses		
EDLDR 533	The Politics of Local School Districts	3
EDLDR 549	School District Improvement and Systemic Change	3
C-S 551	Curriculum Design: Theory and Practice	3
EDLDR 865	Human Resources Leadership in Education	3
EDLDR 573	Public School Finance	3
EDLDR 578	Schools as Organizations	3
EDLDR 595	Internship	3
Total Credits		21

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

Core Standard #1: The leader has knowledge and skills to think and plan strategically, creating an organizational vision around personalized student success.

- 1A Demonstrates how to work with a Board of Ed to accomplish a strategic goal or objective
- 1B Demonstrates how to facilitate the development of a shared vision for personalized student success
- 1C Demonstrates how to apply strategic thinking and change strategies to address student achievement challenges at the district level.
- 1D Demonstrates how to work with a team to create and implement strategic, operational and tactical plans that demonstrate desired results.
- 1E Demonstrates how to lead a team through a district level problem solving process resulting in a plausible solution
- 1F Demonstrates how to apply a range of leadership styles appropriate to a variety of contexts.

Core Standard #2: The leader is grounded in standards-based systems theory and design and is able to transfer knowledge to his/her job as an architect of standards-based reform in the school.

- 2A Demonstrates the ability to implement a district wide standards based reform initiative.
- 2B Demonstrates how to apply systems thinking in decision making situations.
- 2C Demonstrates ability to focus adequate resources on reform efforts.
- 2D Demonstrates ability to align reform efforts with federal, state and district requirements.

Core Standard #3: The leader knows how to access and use appropriate data to inform decision-making at all levels of the system.

- 3A Demonstrates the ability to lead decision making processes appropriate to the situation.
- 3B Demonstrates how to structure problems for solution and frame issues for resolution.
- 3C Demonstrates how to use assessment and evaluation information for continuous improvement efforts
- 3D Demonstrates how to use data and information to inform decisions.

Corollary Standard #1: The leader creates a culture for teaching and learning with an emphasis on learning.

- 1A Demonstrates the ability to apply research based best practices to solve school reform problems and challenges.
- 1B Applies best practices to establish and improve the organizational climate across the education community.
- 1C. Models the attributes of a continuous learner and the expectation for others.
- 1D Demonstrates the ability to plan and execute plans to ensure the safest and most secure environment across the district.

Corollary Standard #2: The leader effectively manages resources for effect results.

- 2A Knows how to develop a budget plan that is aligned to district goals and priorities.
- 2B Exhibits the ability to ensure that technology is appropriately implemented throughout the district.
- 2C Knows how to manage resources effectively.
- 2D Demonstrates how to increase and allocate resources.

- 2E Demonstrates how to interpret the results produced.
- 2F Demonstrates knowledge of regulations and policies and how to interpret them accurately and apply them appropriately.
- 2G Demonstrates how to provide consistent and effective management practice through written policies and procedures.

Corollary Standard #3: The Leader collaborates, communicates, engages, and empowers others inside and outside the organization to pursue excellence in learning.

- 3A Demonstrates how to establish and improve the culture of learning throughout the district.
- 3B Demonstrates effective communication abilities.
- 3C Demonstrates how to involve key community district and school stakeholders in reform efforts.
- 3D Models appropriate leadership behavior and develops leadership skills in others through mentoring and coaching.
- 3E Demonstrates how to assemble appropriate stakeholders into effective teams for problem solving.

Corollary Standard #4: The Leader operates in a fair and equitable manner with personal and professional integrity.

- 4A Demonstrates impeccable personal and professional ethics at all times.
- 4B Demonstrates how to embrace and utilize diversity to improve performance and learning.
- 4C Demonstrates how to use data and information from multiple sources to improve decision making.
- 4D Demonstrates how to address conflict and resolve differences to achieve effective results.

Corollary Standard #5: The Leader advocates for children and public education in the larger political, social, economic, legal, and cultural context.

- 5A Demonstrates how to identify and interpret external influences and how they impact on local education decisions.
- 5B Exhibits continues focus on all children and their individual needs.
- 5C Exhibits sound judgment in operational and educational decisions to maximize learning opportunities of all children.
- 5D Demonstrates how to engage with governmental and political leaders to effectively address the developmental and educational needs of all children.
- 5E Demonstrates knowledge of the law.

Corollary Standard #6: The Leader supports professional growth of self and others through practice and inquiry.

- 6A Demonstrates how to use professional development as a way to increase individual and institutional capability.
- 6B Demonstrates how to engage staff and Board members in relevant professional development activities.
- 6C Demonstrates the ability to identify and nurture individual strengths and leverage the human resources to benefit the district
- 6E Demonstrates how to design professional development plans that lead to improved student learning.

Graduate Program Head
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)
Program Contact

University Park
 David Gamson
 Edward J Fuller
 Mark Ivicic
 200 Rackley Building
 Penn State University
 University Park PA 16802
 mci104@psu.edu

Supply Chain and Operations Management Graduate Credit Certificate Program

Person-in-Charge Dinesh R. Pai
Program Code SCOPM
Campus(es) Harrisburg

The goal of this 12 credit certificate program is to better prepare operations and supply chain management professionals with those contemporary skills and concepts necessary for the effective and efficient management of the physical, informational, and financial flows that collectively form the networks that add value to firms competing on a global scale. Students will

unless the student has earned a graduate degree from an accredited university.

Ideally, the applicant should have a working knowledge of Microsoft Excel and business statistics, plus a basic understanding of accounting principles.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
MNGMT 522	Operations and Supply Chain Management	3
Electives		
Select two of the following:		6
MANGT 510	Project Management	
SCIS 540	Transportation and Distribution Management	
SCIS 546	Procurement and Supply Management	
SCIS 570	Supply Chain Engineering	
Culminating Experience		
SCIS 565	Supply Chain Strategy (Capstone Course)	3
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Explain the importance of operations and supply chain management and its role in a firm's productivity and strategy.
2. Develop and apply tools to manage projects, improve processes, demand forecasting, sourcing, and inventory management.
3. Apply supply chain analytics tools to drive data driven business decisions.
4. Discuss how strategic sourcing can contribute to organizational goals.
5. Apply economic concepts to transportation. Explain how modal economics have led to current transportation policy. Explain the problems with current public policy with regard to transportation.

Contact

Campus	Harrisburg
Graduate Program Head	Dinesh Ramdas Pai
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Dinesh Ramdas Pai
Program Contact	Amy J Atkins 777 W. Harrisburg Pike, PSU E355 School of Business Administration Middletown PA 17057 akj11@psu.edu (717) 948-6142
Program Website	View (https://harrisburg.psu.edu/business-administration/supply-chain-management/graduate-certificate-operations-supply-chain-management/)

Supply Chain Management Graduate Credit Certificate Program

Person-in-Charge	Kevin Linderman
Program Code	SCMGT
Campus(es)	World Campus

The Graduate Certificate in Supply Chain Management is a 12-credit online professional development program focused on building competence across the foundations of supply chain management. Through integration of strategic procurement, supply management, manufacturing, service operations, and demand fulfillment, this two-semester program positions students to manage and enhance the value of today's complex supply chains. In addition to core supply chain principles, topics in ethics, performance metrics, financial analysis, and information systems are covered. The certificate program starts with basic supply chain concepts that professionals are expected to know and then uses a best-practices approach to build supply chain skills and analytical capabilities.

Effective Semester: Fall 2020

Expiration Semester: Fall 2025

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Applicants should have at least two years of professional experience along with an understanding of basic accounting and microeconomic terms and principles. Spreadsheet skills and knowledge of business statistics are necessary for successful participation in the program.

Along with the submission of the online application and the nonrefundable application fee, the following is required:

- Official Transcripts – Submit official transcripts from all post-secondary institutions attended, regardless of the number of credits or semesters completed. Transcripts not in English must be accompanied by a certified translation.
- Application –Completion of the Graduate School certificate application.
- Statement of Purpose – Applicants must describe how professional experience and goals align with the Certificate in Graduate Certificate in Supply Chain Risk Management, not to exceed 500 words.
- Vita or Résumé – Provide a one- to two-page listing of professional experience and education.

GRE or GMAT test scores are NOT required.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
SCM 800	Supply Chain Management	3
SCM 801	Supply Chain Performance Metrics and Financial Analysis	3
SCM 822	Supply Management	3
SCM 842	Operations Management and Demand Fulfillment	3
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **SCM METHODS:** Students will be able to demonstrate knowledge of best practices used in monitoring, managing and improving supply chains.
2. **SCM METRICS:** Students will be able to identify and measure essential metrics that are key indicators of supply chain performance.
3. **SUPPLY CHAIN DESIGN:** Students will be able to identify key strategic issues for designing supply chains.
4. **SUPPLY CHAIN FINANCIALS:** Students will be able to demonstrate knowledge of supply chain financial measures and be able to analyze how supply chain decisions impact the financial success of the enterprise.
5. **BUSINESS ETHICS:** Students will be able to identify business and professional ethics associated with SCM, both domestically and internationally.

Contact

Campus	World Campus
Graduate Program Head	Kevin Linderman
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	David J Huff
Program Contact	Michelle Kristen Rockower 219C Business Building University Park PA 16802 mkk114@psu.edu (814) 865-5290
Program Website	View (http://www.smeal.psu.edu/mps/gradcert/)

Supply Chain Risk Management Graduate Credit Certificate Program

Person-in-Charge	Kevin Linderman
Program Code	SCRM
Campus(es)	World Campus

The Graduate Certificate in Supply Chain Risk Management is offered by the Smeal College of Business. Risk Management is becoming increasingly essential for Supply Chains. This certificate will provide students with foundational knowledge of Supply Chain Risk Management theory and best practices. The graduate certificate is a 12-credit program that can be completed in one calendar year.

Effective Semester: Fall 2022
Expiration Semester: Fall 2027

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Other admissions requirements include:

- Official Transcripts – Submit official transcripts from all post-secondary institutions attended, regardless of the number of credits or semesters completed. Transcripts not in English must be accompanied by a certified translation.
- Application –Completion of the Graduate School certificate application.
- Statement of Purpose – Applicants must describe how professional experience and goals align with the Certificate in Graduate Certificate in Supply Chain Risk Management, not to exceed 500 words.
- Vita or Résumé – Provide a one- to two-page listing of professional experience and education.

GRE or GMAT test scores are NOT required.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
SCM 800	Supply Chain Management	3
IST 564	Crisis, Disaster and Risk Management	3
SCM 863	Managing Supply Chain Risk and Resiliency	3
IST 803	Cybersecurity Foundations	3
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

- Graduates will be able to demonstrate competency in the foundational concepts of supply chain management
- Graduates will be able to demonstrate competency in the foundational concepts of knowledge management
- Graduates will be able to demonstrate competency in the concepts and practices of risk management

Contact

Campus	World Campus
Graduate Program Head	Kevin Linderman
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	David J Huff
Program Contact	Michelle Kristen Rockower mkk114@psu.edu (814) 865-5290
Program Website	View (https://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-supply-chain-risk-management-graduate-certificate/overview/)

Survey Research Methods Graduate Credit Certificate Program

Person-in-Charge	Eric Plutzer
Program Code	SURRES
Campus(es)	University Park

The certificate in Survey Research Methods shall provide supplemental training to graduate students in social science, health, education, and policy-related graduate programs at Penn State. The collection of data by questionnaire, web surveys, phone or personal structured interviews is a highly specialized technique whose "best practices" and "cutting edge" change frequently. The data collected by surveys typically violate assumptions of random sampling that undergird graduate-level courses in applied statistics. Those earning this certificate will have supplemental training in data collection and take a coherent cluster of courses in applied statistics that will provide them with superior preparation for completion of their dissertation, and for employment in the academic, public, and private sectors.

Effective Semester: Summer 2019

Expiration Semester: Summer 2024

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

All applicants must be enrolled in and have completed 18 credits in a graduate degree program at Penn State. A graduate grade-point average of 3.30 or higher shall normally be required. All applicants will be required to submit a letter from their academic adviser or department head that explains how the certificate program will enhance the student's primary course of study.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

All certificate recipients will be required to complete two core courses, two additional electives at the 500 level, and one hands-on internship or apprenticeship experience.

Code	Title	Credits
Required Courses		
PLSC/SOC 518	Survey Methods I: Survey Design	3
PLSC/SOC 519	Survey Methods II: Analysis of Survey Data	3
PLSC/SOC 595A	Survey Research Practicum	1
Electives		

In addition to the required courses listed above, students must select any two additional 3-credit courses in intermediate or advanced applied statistics or interviewing techniques, as approved by the chair of the Survey Research Center (SRC) Faculty Advisory Committee.¹

Total Credits 13

¹ There is no specific list of courses because offerings in the social and behavioral sciences change frequently and are most often offered under the 597 rubric. As a general rule, these courses must be at the 500 level, and they must have prerequisites equivalent to two semesters of applied statistics. For example, offerings in SOC that require prior completion of SOC 574-SOC 575 and offerings in PLSC that require prior completion of PLSC 502-PLSC 503 would normally be eligible. We will apply comparable criteria for advanced methodology electives in departments such as (but not restricted to) Human Development and Family Studies, Education, and Psychology. These departments have offered relevant courses on topics such as:

- Hierarchical Modeling,
- Latent Class Analysis,
- Item Response Theory,
- Time Series,
- Analysis,
- Survival Analysis,
- and the Analysis of Missing Data.

In addition, some regularly offered classes, such as HDFS 526, SOC 578, and STAT 506, would satisfy the requirement.

Students accepted into the certificate program will submit a "Planned Program of Study" form annually. Approval by the Chair of the SRC Faculty Advisory Committee shall constitute formal approval for a course to count in meeting this requirement. All courses used to meet the requirements of the Certificate may be double-counted towards the student's doctoral degree program if permitted by the program.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Students will become familiar with key theoretical and methodological paradigms in modern survey research.
2. Students will acquire skills in the analysis of surveys employing clustering, differential probability of selection, and stratification.
3. Students will learn how to apply the Total Survey Error framework to data analysis and questionnaire design.
4. Students will learn about modern alternatives to sample surveys, including non-probability web panel methodology.
5. Students will integrate this knowledge in an applied internship.

Contact

Campus	University Park
Graduate Program Head	Eric Plutzer
Program Contact	Eric Plutzer 322 Pond Lab University Park PA 16802 exp12@psu.edu (814) 865-6576
Program Website	View (https://polisci.la.psu.edu/graduate/programs-of-study/graduate-certificate-in-survey-methodology/)

Sustainability & Social Impact Graduate Credit Certificate Program

Person-in-Charge	Zungang Liu
Program Code	SUSSIM
Campus(es)	Great Valley

This Revised Graduate Certificate in Sustainability & Social Impact (originally Sustainable Management Practices) can help you manage new or existing sustainable practices in your organization. Gain a competitive advantage by understanding how adopting the 'triple bottom line' can enhance your organization's long-term viability.

Effective Semester: Fall 2022
Expiration Semester: Fall 2027

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

The successful applicant is generally expected to have a minimum combined junior/senior grade-point average of 3.0 (B) on a 4.0 scale.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

To be awarded the graduate certificate, students must successfully complete 9 credits of course work consisting of 3 required credits and 6 elective credits. All courses must be completed with a minimum grade of C or better and an overall GPA of 3.0.

Code	Title	Credits
Required Courses		

BUSAD 802	Cornerstone of Sustainability	3
Electives (choose 2 courses from the following):		6
BUSAD 824	Finance and Investment for Sustainable Growth	
BUSAD 809	Triple Bottom Line Accounting	
BUSAD 879	Sustainable Supply Chain Management	
BUSAD/LEAD 556	Diversity Leadership	
BUSAD/LEAD 882	Social Entrepreneurship and Community Leadership	
MGMT 507	Positive Organizational Behavior and Wellbeing	
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Demonstrate a critical capacity for reflection and action, based upon a systems thinking framework, the environmental and organizational sustainability challenges facing business leaders.
2. Design, implement and/or evaluate new or existing sustainable practices within an organization.
3. Critically evaluate and make sustainable decisions with consideration for multiple stakeholders.
4. Demonstrate effective oral and written communication skills.

Contact

Campus	Great Valley
Graduate Program Head	Zugang Liu
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Cynthia D Walton-Bongers
Program Contact	DENISE Y. SMITH 30 E Swedesford Road Malvern PA 19460 dms7338@psu.edu (610) 648-3336
Program Website	View (https://greatvalley.psu.edu/academics/graduate-certificates/sustainability/)

Sustainability Management and Policy Graduate Credit Certificate Program

Person-in-Charge	Erich Schienke
Program Code	SUSPOL
Campus(es)	World Campus

The graduate certificate in Sustainability Management and Policy is designed specifically for current and aspiring practitioners who seek advanced skills for advancing sustainability practice. The program is offered by the Department of Energy and Mineral Engineering through Penn State's World Campus.

Courses taken in the certificate program may be applied toward the Master of Professional Studies in Renewable Energy and Sustainability Systems (RESS) if the student has earned a B- or better in each course, subject to restrictions outlined in GCAC-309 Transfer Credit (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/transfer-credit/>). Certificate students who wish to have certificate courses applied towards the M.P.S. in RESS must apply and be admitted to that degree program. Admission to the RESS graduate degree program is a separate step and is not guaranteed.

Effective Semester: Fall 2023

Expiration Semester: Fall 2028

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Certificate students earn the certificate and 12 graduate credits by successfully completing each of the four required 3-credit, instructor-led online courses with a grade of C or better.

Code	Title	Credits
Required Courses		
BA 850	Sustainability Driven Innovation	3
EME 803	Applied Energy Policy	3
EME 805	Renewable Energy and Nonmarket Enterprise	3
EME 807	Technologies for Sustainability Systems	3
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **SUSTAINABILITY:** Students will be able to demonstrate knowledge of the fundamental principles of sustainability and apply various methods for assessing sustainability indicators.
2. **ANALYSIS:** Students will be able to analyze market and non-market conditions for renewable energy enterprise and sustainable technology or product development.
3. **COMMUNICATION:** Students will be able to identify and communicate key policy features for renewable energy and sustainability pathways.
4. **SYSTEMS THINKING:** Students will be able to address and assess key features of coupled human-environment systems.

Contact

Campus	World Campus
Graduate Program Head	Erich William Schienke
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Erich William Schienke
Program Contact	Noelle Fetzer Capparelle 2217 Earth Engr Sciences University Park PA 16802 nlf5@psu.edu (814) 867-5401
Program Website	View (https://www.ress.psu.edu/certificates/)

Sustainable Development in Africa Graduate Credit Certificate Program

Person-in-Charge	Kidane Mengisteb
Program Code	SDVAF
Campus(es)	University Park

Climate change has become a serious challenge to sustainable development worldwide. The African continent seems to have been disproportionately impacted by climate change. In addition to global warming, the African continent is facing rapid population growth, rapid urbanization, rapid growth of extractive industries, and rapid deforestation. All these developments have created an alarming rate of environmental degradation. The continent also has low adaptation capacity to global warming and is already producing a growing number of environmental refugees. This 12-credit Certificate in Sustainable Development in Africa aims to engage graduate students with the issues, debates, and analyses related to sustainable and equitable development in Africa. Students will learn about the key global and regional drivers of environmental degradation, how the environmental degradation has impacted African societies, and how Africa may develop effective adaptation mechanisms to withstand or even reverse the degradation process. This certificate will provide students an opportunity to engage with current topics from a specifically African perspective, and

it foregrounds competency in the UN Sustainability Goals in line with similar priorities in Penn State Global and the Sustainability Institute. Students will receive training in development theory and practice to understand the place of Africa in global environmental change. Students will learn to critically analyze the complex interrelationships and trade-offs between development and environmental costs. Students can choose to focus on an area of study such as: resource extraction (e.g., mining) and governance, food and agriculture, water, renewable energy (e.g., solar), and development practice. Students are encouraged but not required to pursue study abroad and embedded travel opportunities on the African continent with a specific focus on sustainability.

Effective Semester: Fall 2023

Expiration Semester: Fall 2028

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Students enrolled in graduate programs at Penn State University and non-degree students currently not enrolled in a graduate degree program may apply to the African Studies Program for admission to this certificate program via the Graduate School application. The requirements for admission for students in degree programs include relevant academic background and a GPA of 3.0. Admission requirements for non-degree applicants include relevant academic background, work experience, and a GPA of 2.5 and above.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

To earn a graduate certificate in sustainable development in Africa, a minimum of 12 credits of graduate and 400 level courses is required. **No more than 3 credits may come from individual studies, and no more than 6 credits may come from 400 level courses.**

Code	Title	Credits
Required Courses		
6 to 9 credits from the following courses:		6-9
AFR 501	Key Issues in African Studies	
AFR 527	Migration, Urbanization, and Policy in the Developing World	
AFR 532	Environment and Livelihoods in Africa	
AFR 534	Political Economy of Energy and Extractive Industries in Africa (Oil and Mining)	
AFR 434	War and Development in Africa	
3-6 credit from the following relevant African Studies courses, or focal topic course offered by other units:		3-6

AFR 596	Individual Studies
AFR 464	Extractive Industries in Africa
AFR 440	Globalization and Its Implications
AYFCE 535	Youth Civic Development
INTAD 820	International Agricultural Development Seminar
FOR 440	Forest and Conservation Economics
INTAD 577	Global Agricultural Systems
FOR 418	Agroforestry: Science, Design, and Practice
GEOG 430	Human Use of Environment

Total Credits**12**

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Critically analyze key factors that impact adversely sustainable development in Africa as well as in the rest of the world.
2. Appraise Africa's environmental degradation and its impacts on African societies.
3. Analyze and evaluate different policy measures of adaptability to environmental changes and sustainable development in Africa.

Contact

Campus	University Park
Graduate Program Head	Kidane Mengisteab
Program Contact	Ashley Marie Scott ams87@psu.edu (814) 865-2484
Program Website	View (https://africanstudies.la.psu.edu/graduate/cerificates/sustainable-development-in-africa/)

System Modeling and Analysis Graduate Credit Certificate Program

Person-in-Charge	Raghu Sangwan
Program Code	MENGSM
Campus(es)	Great Valley World Campus

The Graduate Certificate in System Modeling and Analysis is a program for students who aim to pursue a career as a System Analyst, Systems Test Engineer, or System Engineer where skills will include responsibilities including being responsible for designing, building, maintaining models for system analysis and optimization, building models for system verification and testing, or development and documentation of technical aspects of system in any life cycle phase (concept, design, implementation, operation, maintenance).

Courses taken in the certificate program may be applied toward a master's degree in Systems Engineering, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards a graduate degree must apply and be admitted to that degree program. Admission to the graduate degree program is a separate step and is not guaranteed.

Effective Semester: Spring 2024**Expiration Semester:** Spring 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

1. The successful applicant is generally expected to have a minimum combined junior/senior grade-point average of 3.0 (B) on a 4.0 scale.
2. Courses taken in the certificate program may be applied toward Master of Systems Engineering degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards the Master of Systems Engineering must apply and be admitted to that degree program. Admission to the Master of Software Engineering graduate degree program is a separate step and is not guaranteed.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
SYSEN 532	Simulation in Systems Engineering: Discrete-Time Systems	3
SYSEN 534	Simulation in Systems Engineering: Continuous-Time Systems	3
SYSEN 880	Systems Architecture and Models	3
Total Credits		9

All courses must be completed with a minimum grade of C or better and an overall GPA of 3.0.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up

deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **APPLY/CREATE:** Use system simulation modeling for multi-level system analysis of complex systems and for identification of optimal solution alternatives
2. **APPLY/CREATE:** Apply model-based system engineering practices for design, architecting, and engineering of systems

Contact

Campus Great Valley
Graduate Program Head Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC) Raghu Sangwan
Program Contact MICHELLE WHALEN
 30 E. Swedesford Rd.
 Malvern PA 19355
 mmw6441@psu.edu

Campus World Campus
Graduate Program Head Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC) Nil Hande Ergin
Program Contact MICHELLE WHALEN
 30 E. Swedesford Rd.
 Malvern PA 19355
 mmw6441@psu.edu

System Quality & Risk Evaluation Graduate Credit Certificate Program

Person-in-Charge Raghu Sangwan
Program Code MENGSO
Campus(es) Great Valley
 World Campus

The Graduate Certificate in System Quality & Risk Evaluation is a program for students who aim to pursue a career as a Test Manager, Systems Test Engineer, Systems Integration Engineer, System Analyst, or Risk Analyst where skills will include responsibilities for planning test and evaluation activities and overseeing testing activities, designing and implementing test strategies to ensure system quality, developing and managing interoperability across systems, analyzing system qualities, troubleshooting test failures, or analyzing models and system risks.

Courses taken in the certificate program may be applied toward a master's degree in Systems Engineering, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards a graduate degree must apply and be admitted to that degree program. Admission to the graduate degree program is a separate step and is not guaranteed.

Effective Semester: Spring 2024
Expiration Semester: Spring 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

1. The successful applicant is generally expected to have a minimum combined junior/senior grade-point average of 3.0 (B) on a 4.0 scale.
2. Courses taken in the certificate program may be applied toward Master of Systems Engineering degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards the Master of Systems Engineering must apply and be admitted to that degree program. Admission to the Master of Software Engineering graduate degree program is a separate step and is not guaranteed.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
SYSEN 520	Systems Engineering	3
SYSEN 522	Systems Verification Validation & Testing	3
SYSEN 536	Decision and Risk Analysis in Engineering	3
Total Credits		9

All courses must be completed with a minimum grade of C or better and an overall GPA of 3.0.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **APPLY/CREATE:** Design, analyze and evaluate system qualities of complex systems using verification, validation, testing methods and tools.
2. **THINK:** Analyze tradeoffs and alternatives for system problems and analyze risks and their impact on the decision-making process

Contact

Campus	Great Valley
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Nil Hande Ergin
Program Contact	MICHELLE WHALEN 30 E. Swedesford Rd. Malvern PA 19355 mmw6441@psu.edu

Campus	World Campus
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Nil Hande Ergin
Program Contact	MICHELLE WHALEN 30 E. Swedesford Rd. Malvern PA 19355 mmw6441@psu.edu

Systems Data Analytics Graduate Credit Certificate Programs

Person-in-Charge	Raghu Sangwan
Program Code	MDASDA
Campus(es)	Great Valley World Campus

The Graduate Certificate in Systems Data Analytics is a program for students who aim to pursue a career as a System or Risk Analyst where skills will include responsibilities in providing project management for systems implementations, analyzing business process issues design, build, and analyze models, analyzing and determining system risks and examining and interpreting statistical data.

Courses taken in the certificate program may be applied toward a master's degree in Data Analytics, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards a graduate degree must apply and be admitted to that degree program. Admission to the graduate degree program is a separate step and is not guaranteed.

Effective Semester: Spring 2024
Expiration Semester: Spring 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

1. The successful applicant is generally expected to have a minimum combined junior/senior grade-point average of 3.0 (B) on a 4.0 scale.

2. Courses taken in the certificate program may be applied toward Master of Software Engineering degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards the Master of Software Engineering must apply and be admitted to that degree program. Admission to the Master of Software Engineering graduate degree program is a separate step and is not guaranteed.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
ENGMT 520	Systems Optimization	3
SYSEN 532	Simulation in Systems Engineering: Discrete-Time Systems	3
SYSEN 536	Decision and Risk Analysis in Engineering	3
Total Credits		9

All courses must be completed with a minimum grade of C or better and an overall GPA of 3.0.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **KNOW** - Analyze problems and develop capabilities with appropriate and meaningful data while using simulation and optimization tools for proper decision making.
2. **APPLY/CREATE** - Examine and interpret statistical data for estimation of risk and their impact on the decision-making process as applied to the technical problems.
3. **APPLY/CREATE** - To introduce the principles, concepts, techniques and tools for visualizing information in large complex data sets.

Contact

Campus	Great Valley
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Adrian Sorin Barb
Program Contact	Sharon V. Patterson 30 E. Swedesford Rd. Malvern PA 19460 svp40@psu.edu (610) 648-3318

Campus	World Campus
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Adrian Sorin Barb
Program Contact	Sharon V. Patterson 30 E. Swedesford Rd. Malvern PA 19460 svp40@psu.edu (610) 648-3318

Talent Management Graduate Credit Certificate Program

Person-in-Charge	Paul Clark
Program Code	TLNTMG
Campus(es)	University Park World Campus

The 9-credit graduate certificate in Talent Management is designed to prepare HR professionals, managers, and leaders with the knowledge and skills needed to attract, develop, reward, and retain top talent, thereby driving organizational success.

Courses taken in the certificate program may be applied toward a master's degree in HRER, subject to restrictions outlined in [GCAC-309 Transfer Credit](#). Certificate students who wish to have certificate courses applied towards a graduate degree in HRER must apply and be admitted to that degree program. Admission to the HRER graduate degree program is a separate step and is not guaranteed.

Effective Semester: Spring 2024
Expiration Semester: Spring 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

- Applicants with a 3.00 junior/senior grade-point average (on a 4.00 scale) will be considered for admission. Exceptions to the minimum grade-point average may be made at the discretion of the program for students with special backgrounds, abilities, and interests;
- #All applicants submit a Graduate School application (including payment of the nonrefundable application fee), resume, and personal statement addressing their reasons for pursuing a certificate in talent management;
- The resume and personal statement are waived if a student is currently enrolled in the MHRER or MS HRER degree programs.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

All courses must be completed with a grade of C or better and a grade-point average of 3.0 to be awarded the certificate.

Code	Title	Credits
Required Courses		
HRER 505	Seminar in Human Resources	3
<i>Choose 6 credits from the following:</i>		6
HRER 824	Total Rewards	
HRER 527	Talent Development and Change Management or HRER 827Talent Development	
HRER 526	Managing Talent Flow or HRER 826Talent Management	
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **Know:** Graduates will have and be able to demonstrate the necessary advanced knowledge and competence in talent management to excel in their careers.
2. **Think:** Graduates will be able to recognize and analyze practical, legal, and ethical challenges related to talent management issues in workplaces.
3. **Apply/Create:** Graduates will be able to conduct independent inquiries to identify current scholarship and best practices and effectively apply relevant theories and practices when solving problems in talent management.
4. **Communicate:** Graduates will be able to effectively communicate knowledge of current topics to excel as talent management professionals.
5. **Professional Practice:** Graduates should display behavior consistent with the highest ethical standards related to talent management.

Contact

Campus	University Park
Graduate Program Head	Paul Clark
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Brian Francis Redmond
Program Contact	Erin Hetzel eab27@psu.edu (814) 867-4167

Campus	World Campus
Graduate Program Head	Paul Clark
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Brian Francis Redmond
Program Contact	Erin Hetzel eab27@psu.edu (814) 867-4167

Taxation Graduate Credit Certificate Program

Person-in-Charge	Henock Louis
Program Code	TAX
Campus(es)	World Campus

The Graduate Certificate in Taxation is a 9-credit program designed to be an engaging, practical, and comprehensive program that provides students with a working understanding of tax laws and regulations. With course work covering topics on Research and Analysis, Corporate Taxes, Pass-Through Taxes, International Taxes, State and Local Taxes, and Ethical Responsibilities, the Taxation Graduate Certificate provides a solid foundation of skills needed for leadership positions and career advancement.

Course content focuses on: the ability to think strategically about tax issues and challenges, development of effective strategies for organizational performance and success, the ethical and societal implications of tax decisions, as well as an exploration of unique approaches to strategic planning.

Effective Semester: Fall 2021
Expiration Semester: Fall 2026

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Other admissions requirements include:

- **Application** – Complete a Graduate School application (<http://gradschool.psu.edu/prospective-students/how-to-apply/>) for graduate study including nonrefundable application fee.
- **Statement of Purpose** – Submit a statement describing how professional experience and goals align with the certificate.
- **Vita or resume** – Submit a statement outlining professional experience history.

GRE or GMAT test scores are NOT required.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate

Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Students will choose 9 credits from the following courses:		
ACCTG 812	TAXATION	9
ACCTG 522	Corporate Taxation and Financial Reporting	
ACCTG 823	Taxation of Pass-Through Entities	
ACCTG 826	International Taxation	
ACCTG 827	State and Local Taxation	
Total Credits		9

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

- Demonstrate knowledge of fundamental topics, theories, concepts, and frameworks in tax
- Understand how to formulate, implement, and evaluate tax strategies
- Demonstrate the ability to competently analyze and explain tax laws
- Understand tax research concepts and methodologies
- Understand the ethical constructs that apply to the practice of taxation and why they are necessary

Contact

Campus	World Campus
Graduate Program Head	Henock Louis
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Lawrence Friedken
Program Contact	Michelle Kristen Rockower mkk114@psu.edu (814) 865-5290
Program Website	View (https://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-taxation-certificate/overview/)

Teacher Leadership Graduate Credit Certificate Program

Person-in-Charge	Edward J. Fuller
Program Code	TLC
Campus(es)	University Park World Campus

This is a 12-credit program designed to fulfill the requirements for the Teacher Leadership Endorsement Program offered by the Pennsylvania Department of Education for those who already hold Instructional I

certification. The courses allow students to develop the professional knowledge, skills, and competencies required of candidates for the endorsement. The program has four central themes:

1. Teacher Leadership as the Gateway to Enhancing Instructional Effectiveness
2. Peer Mentoring and Its Impact on the Professional Community
3. The Role of Change in the Era of Accountability
4. The School as a Cultural and Political Entity

Effective Semester: Summer 2024

Expiration Semester: Summer 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
EDLDR 559	School Improvement	3
EDLDR 560	Principles of Instructional Supervision	3
EDLDR 801	Introduction to Teacher Leadership	3
EDLDR 802	How Schools Work	3
Total Credits		12

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Professional Licensure/Certification

Many U.S. states and territories require professional licensure/certification to be employed. If you plan to pursue employment in a licensed profession after completing this program, please visit the Professional Licensure/Certification Disclosures by State (<https://www.psu.edu/state-licensure-disclosures/>) interactive map.

Contact

Campus	University Park
Graduate Program Head	Kevin Kinser
Program Contact	Mark Ivicic 200 Rackley Building Penn State University University Park PA 16802 mci104@psu.edu

Campus	World Campus
Graduate Program Head	Kevin Kinser
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Edward J Fuller
Program Contact	Mark Ivicic 200 Rackley Building Penn State University University Park PA 16802 mci104@psu.edu

Technical Management and Leadership Essentials Graduate Credit Certificate Program

Person-in-Charge	Raghu Sangwan
Program Code	MENTML
Campus(es)	Great Valley World Campus

The Graduate Certificate in Technical Management and Leadership Essentials is a program for students who aim to pursue a career as a Project Engineering Manager or Team Lead Manager where skills will include responsibilities to plan, organize and execute a technical project from start to finish and manage technical teams within a technical organization.

Courses taken in the certificate program may be applied toward a master's degree in Engineering Management, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards a graduate degree must apply and be admitted to that degree program. Admission to the graduate degree program is a separate step and is not guaranteed.

Effective Semester: Spring 2024

Expiration Semester: Spring 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

1. The successful applicant is generally expected to have a minimum combined junior/senior grade-point average of 3.0 (B) on a 4.0 scale.
2. Courses taken in the certificate program may be applied toward Master of Engineering Management degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards the Master of Engineering Management must apply and be admitted to that degree program. Admission to the Master of Engineering Management graduate degree program is a separate step and is not guaranteed.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
MNGMT 511	Organizational Behavior	3
STS 589	Ethics and Values in Science and Technology	3
SYSEN 505	Technical Project Management	3
SYSEN 850	Creativity & Problem Solving I	3
Total Credits		12

All courses must be completed with a minimum grade of C or better and an overall GPA of 3.0.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. **APPLY/CREATE** - Demonstrate application of tools and techniques for management of engineering projects with an effective means to communicate the findings to stakeholders
2. **KNOW** - Demonstrate the ability to manage ethical and legal issues and lead multi-disciplinary teams

Contact

Campus	Great Valley
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Nil Hande Ergin
Program Contact	MICHELLE WHALEN 30 E. Swedesford Rd. Malvern PA 19355 mmw6441@psu.edu

Campus	World Campus
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Nil Hande Ergin
Program Contact	MICHELLE WHALEN 30 E. Swedesford Rd. Malvern PA 19355 mmw6441@psu.edu

Technical Management Graduate Credit Certificate Program

Person-in-Charge	Raghu Sangwan
Program Code	MENGTM
Campus(es)	Great Valley World Campus

The Graduate Certificate in Technical Management is a program for students who aim to pursue a career as a Program Manager, Project Manager, Lead System Engineer, or Test Manager where skills will include responsibilities for overseeing and coordinating projects within organizations, planning, organizing, and executing a project from start to finish, designing, implementing, and coordinating technical design aspects of a system, or planning, testing, and evaluating activities and oversee testing activities and testing teams.

Courses taken in the certificate program may be applied toward a master's degree in Systems Engineering, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards a graduate degree must apply and be admitted to that degree program. Admission to the graduate degree program is a separate step and is not guaranteed.

Effective Semester: Spring 2024

Expiration Semester: Spring 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

1. The successful applicant is generally expected to have a minimum combined junior/senior grade-point average of 3.0 (B) on a 4.0 scale.
2. Courses taken in the certificate program may be applied toward Master of Systems Engineering degree, subject to restrictions outlined in GCAC-309 Transfer Credit (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/>). Certificate students who wish to have certificate courses applied towards the Master of Systems Engineering must apply and be admitted to that degree program. Admission to the Master of

Software Engineering graduate degree program is a separate step and is not guaranteed.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

Code	Title	Credits
Required Courses		
SYSEN 505	Technical Project Management	3
SYSEN 507	Systems Thinking	3
SYSEN 850	Creativity & Problem Solving I	3
Total Credits		9

All courses must be completed with a minimum grade of C or better and an overall GPA of 3.0.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

- APPLY/CREATE:** Design, analyze and evaluate system qualities of complex systems using verification, validation, testing methods and tools
- THINK:** Analyze tradeoffs and alternatives for system problems and analyze risks and their impact on the decision-making process

Contact

Campus	Great Valley
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Nil Hande Ergin
Program Contact	MICHELLE WHALEN 30 E. Swedesford Rd. Malvern PA 19355 mmw6441@psu.edu

Campus	World Campus
Graduate Program Head	Raghu Sangwan
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	Nil Hande Ergin
Program Contact	MICHELLE WHALEN 30 E. Swedesford Rd. Malvern PA 19355 mmw6441@psu.edu

Translational Science Graduate Credit Certificate Program

Person-in-Charge	Gail D. Thomas
Program Code	HYTRSC
Campus(es)	Hershey University Park

The primary goal of this certificate is to provide a formal, structured program that allows medical and health care professionals, those wanting to enter the area of health care research, and graduate students seeking a career in a health care related discipline to develop or enhance a successful career in translational science.

Effective Semester: Summer 2023
Expiration Semester: Summer 2028

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

The curriculum includes courses in 4 specific translational science clusters. Students are required to complete 15 credits, including a 10 credit core of required 500-level courses and 5 elective credits. Courses must be selected from the detailed curriculum, or by permission in advance from the certificate director. Courses are available at the Hershey and University Park Campuses enabling the student to continue employment activities or graduate school programs. Students must obtain a B or better in each course.

Code	Title	Credits
Required Courses		
Select one of the following:		3
PHS 520	Principles of Biostatistics	
STAT 500	Applied Statistics	
STAT 501	Regression Methods	
Select one of the following:		3
PHS 550	Principles of Epidemiology	
HPA 540	Epidemiological Applications in Health Services Research	
STAT 507	Epidemiologic Research Methods	
Select one of the following:		3
PHS 580	Clinical Trials: Design and Analysis	

STAT 503	Design of Experiments	
STAT 509	Design and Analysis of Clinical Trials	
Select one of the following:		1
PHS 500	Research Ethics for Clinical Investigators	
MCIBS 591	Ethics, Rigor, Reproducibility and Conduct of Research in the Life Sciences	
BMS 591	Biomedical Research Ethics	
Electives		
Select 5 credits from the following:		5
BBH 505	Behavioral Health Research Strategies	
BIOL 555	Statistical Analysis of Genomics Data	
BMMB 852	Applied Bioinformatics	
BMS 801	Writing Grant Proposals for Biomedical Research	
CTS 590	Colloquium	
HPA 528	Health Data Analysis for Research	
HPA 564	Research Methods in Health Services Research	
HDFS 503	Human Development Intervention: Analysis of Theories and Approaches	
HDFS 516	Methods of Research in Human Development	
KINES 588	Scientific Writing in Kinesiology	
MCIBS 555	Statistical Analysis of Genomics Data	
NUTR 540	Research Methods	
PHS 518	Scientific Communication	
PHS 519	Patient Centered Research	
PHS 521	Applied Biostatistics	
PHS 536	Health Survey Research Methods	
PHS 540	Decision Analysis for Public Health	
STAT 555	Statistical Analysis of Genomics Data	

Total Credits **15**

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

- TS STAT:** Students will be able to apply appropriate statistical principals and analyses to translational science.
- TS EPI:** Students will be able to apply basic epidemiological principles and methods to translational science.
- TS METHODS:** Students will be able to identify, design, implement, and evaluate evidence-based approaches to translational science.
- TS ETHICS:** Students will be able to apply ethical principals and meet high ethical standards in planning, conducting, and reporting of research and protection of human and animal subjects.
- TS COMM:** Students will be able to write scientific reports and journal articles and to give scientific presentations.

Contact

Campus	Hershey Med Ctr
Graduate Program Head	Gail D Thomas
Program Contact	Karen P Shields Penn State College of Medicine P.O. Box 850, MC H147 Hershey PA 17033 kpb2@psu.edu
Program Website	View (http://med.psu.edu/translational-science-certificate/)
Campus	University Park
Graduate Program Head	Gail D Thomas
Program Contact	Karen P Shields 600 University Drive Attn: K.Shields MC 147 Hershey PA 17033 kpb2@psu.edu
Program Website	View (https://med.psu.edu/translational-science-certificate/)

Trauma-Informed Psychotherapy Graduate Credit Certificate Program

Person-in-Charge	Melanie Hetzel-Riggin
Program Code	TRITH
Campus(es)	Erie

The primary goal of this certificate is to prepare mental health professionals, and those in related fields, with training and practice in trauma-focused assessment, diagnosis, and treatment. The curriculum will provide thorough training in trauma informed conceptualization of and empirically-supported treatment for post-traumatic stress disorder and other trauma-related problems.

Effective Semester: Spring 2024

Expiration Semester: Spring 2029

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

An applicant must have a master's degree from a regionally accredited institution of higher education in clinical or counseling psychology, counselor education, marriage and family therapy, or social work, or be concurrently enrolled as a degree student in a Penn State master's degree in clinical or counseling psychology or counselor education.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-212-postbaccalaureate-credit-certificate-programs/>).

All candidates are required to take 12 credits in four courses (trauma and resiliency, foundations in trauma-focused treatment, advanced trauma-focused treatment, and crisis intervention.)

Code	Title	Credits
Required Courses		
PSYCH 442	Trauma and Resiliency	3
PSYC 843	Trauma-Focused Approaches to Psychological Intervention I	3
PSYC 844	Trauma-Focused Approaches to Psychological Intervention II	3
PSYC 845	Crisis and Disaster-Related Interventions in Psychology	3
Total Credits		12

For students concurrently enrolled in a master's degree program, the certificate will be awarded upon completion of the 12 credits required for the certificate. The certificate cannot be awarded prior to completion of the master's degree.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. Describe the psychological theories, models, and research on traumatic stress.
2. Demonstrate effective assessment and diagnosis of trauma-related disorders.
3. Utilize evidence-based treatments for trauma-related disorders.
4. Utilize effective crisis assessment and intervention.

Contact

Campus	Erie
Graduate Program Head	Melanie D. Hetzel-Riggin
Program Contact	Melanie D. Hetzel-Riggin 170 Irvin Kochel Center Behrend Erie PA 16563 mdh33@psu.edu (814) 898-6949

UNIVERSITY COURSE DESCRIPTIONS

The University Course Descriptions section lists all currently active courses at Penn State. Please note that not all courses are offered in any given academic semester. To find class offerings for a specific semester, please view the LionPATH Schedule of Classes (https://public.lionpath.psu.edu/psp/CSPRD/EMPLOYEE/HRMS/c/COMMUNITY_ACCESS.CLASS_SEARCH.GBL?pslnkid=PE_S201801181044562576711220).

Below are definitions for the various components of a course description.

Course-Numbering System

These course descriptions are arranged alphabetically. If any course cannot be located readily, refer to the index. Courses are numbered as follows:

Undergraduate Courses (1 to 399): General courses accepted in fulfillment of requirements for the bachelor's degrees. These courses are described in the Undergraduate Courses section (<https://bulletins.psu.edu/university-course-descriptions/undergraduate/>).

Advanced Undergraduate Courses (400 to 499): Courses open to graduate students and to juniors and seniors and, with the special written permission of the head of the department or the chair of the program sponsoring the course, to qualified students in earlier semesters. These courses are described in the Undergraduate Courses section (<https://bulletins.psu.edu/university-course-descriptions/undergraduate/>).

Graduate Courses (500 to 699; 800 to 899): Courses restricted to students registered in the Graduate School, seniors with an average of at least 3.50 (500- and 800-level only; excludes 600-level), and other students who have been granted permission to enroll by the dean of the Graduate School. These courses are described in the Graduate Courses section (p. 847). Undergraduate students who wish to enroll in 500- or 800-level courses should review the policy and follow the necessary procedures outlined in GCAC-507 Undergraduate Students Taking Graduate Courses (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-500/gcac-507-undergraduate-students-taking-graduate-courses/>).

Medical Courses (700-799): Courses restricted to students registered in the College of Medicine. These courses are described in the College of Medicine Courses section (<https://bulletins.psu.edu/university-course-descriptions/medicine/>).

Law Courses (900-999): Courses restricted to students registered in Penn State Law and Dickinson Law. These courses are described in the Penn State Law Courses section (<https://bulletins.psu.edu/university-course-descriptions/pennstatelaw/>) and Dickinson Law Courses section (<https://bulletins.psu.edu/university-course-descriptions/dickinsonlaw/>).

Common Course Numbers

The following course numbers for which students may register have been set up for common use by major programs, with University Senate approval, to encourage innovation and provide flexibility in designing programs, but in no case may a course be scheduled for 0 credits.

First-Year Seminar 187. Listed under some liberal art-related academic headings, this course has prerequisites of first-semester standing and enrollment in the College of the Liberal Arts.

Research Project Courses 294, 494. 1-12 credits. Supervised student activities on research projects identified on an individual or small-group basis. A specific title may be used in each instance and will be entered on the student's transcript.

Internship 295, 395, 495. 1-18 credits. Supervised off-campus, non-group instruction including field experiences, practica, or internships. Written and oral critique of activity required. A specific title may be used in each instance and will be entered on the student's transcript.

Independent Studies 296, 496. 1-18 credits. Creative projects, including research and design, that are supervised on an individual basis and that fall outside the scope of formal courses. A specific title may be used in each instance and will be entered on the student's transcript.

Special Topics 97, 197, 297, 397, 497; 98, 198, 298, 398, 498. 1-9 credits. Formal courses given infrequently to explore, in depth, a comparatively narrow subject that may be topical or of special interest. Several different topics may be taught in one year or semester. A specific title may be used in each instance and will be entered on the student's transcript.

Foreign Studies 99, 199, 299, 399, 499. 1-12 credits. Courses offered in foreign countries by individual or group instruction. A specific title may be used in each instance and will be entered on the student's transcript. These courses typically carry the International Cultures (IL) attribute.

Graduate Common Courses

Colloquium 590. Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

Research Topics 594. Supervised student activities on research projects identified on an individual or small-group basis.

Internship 595. Supervised, research-oriented, off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

Individual Studies 596. Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

Special Topics 597, 598. Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

Foreign Studies 599. Courses offered in foreign countries by individual or group instruction.

Thesis Research 600, 610. In registering for thesis research, a student uses the appropriate number (600, 610) preceded by the abbreviation designating the major field. The numbers 600 (on campus) and 610 (off campus) are available for credit in thesis research in all graduate major programs. The bursar assesses charges for these courses at the current rate of tuition, according to the student's status at the time of registration.

Ph.D. Dissertation 601, 611. The numbers 601 and 611, with associated special fees, are available to Ph.D. degree candidates who have passed the comprehensive examination and met the two-semester residence requirement. They may be used for dissertation preparation work during its later stages, when the academic activity of the candidate consists

partly (611) or solely (601) of work on the completion of research and writing of the dissertation.

SUBJ 601 and SUBJ 611 do not carry academic credit. They are entered on the academic transcript to indicate the registration and the nature of the candidate's academic activity. A candidate registered for SUBJ 601 is classified as a full-time student, while one registered for SUBJ 611 is classified as a part-time student.

The numbers 600, 601, 610, and 611 may not appear in the Schedule of Courses for each semester.

Supervised Experience in College Teaching 602. May be offered by any graduate program in a department that also offers undergraduate courses. A graduate program with no counterpart undergraduate program may offer SUBJ 602 when cooperative arrangements are made with an administrative unit that does not offer graduate degrees but that uses graduate assistants in its teaching. SUBJ 602 may be offered in any semester and is subject to the following restrictions:

1. SUBJ 602 will not be counted in fulfilling any specific credit requirement for an advanced degree.
2. SUBJ 602 will be graded (A, B, C, D, F). The grade will appear on the student's transcript.
3. SUBJ 602 will not be used in calculating grade-point averages.
4. SUBJ 602 shall be offered only in those graduate programs that want to provide opportunity for supervised and graded teaching experience. Enrollment will be restricted to students for whom the major program is prepared to provide such experience.
5. SUBJ 602 will be counted as a part of the student's credit load unless the program specifies otherwise.

Foreign Academic Experience SUBJ 603. Foreign study and/or research approved by the graduate program for students enrolled in a foreign university constituting progress toward the degree.

Colloquium 890. Continuing, professionally oriented seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

Capstone Experience 894. Supervised, professionally oriented student activities that constitute the culminating experience for the program.

Internship 895. Supervised, professionally oriented, off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

Individual Studies 896. Creative projects with a professional orientation, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

Special Topics 897, 898. Formal courses given on a topical or special interest subject with a professional orientation that may be offered infrequently; several different topics may be taught in one year or semester. A specific title may be used in each instance and will be entered on the student's transcript. Multiple offerings may be accommodated by the use of suffixes A, B, etc.

Foreign Studies 899. Courses with a professional orientation offered in foreign countries by individual or group instruction.

Course Attributes and Suffixes

Attributes and attribute values are course designations that are used to define specific characteristics for courses. The search for specific types of courses uses attributes and attributes are the most important notation for a course to satisfy a given requirement.

Suffixes are letters that follow a course number and allow for easier identification of a course's characteristics. Not all attributes and characteristics are captured in available suffixes and suffixes are not the feature used to determine if a course satisfies a requirement. The degree audit and what-if reports use attributes, not suffixes, to determine applicability of a course to a requirement.

Bachelor of Arts

Attributes

- BA: Arts
- BA: Humanities
- BA: Natural Science
- BA: World Cultures
- BA: Quantification
- BA: Social and Behavioral Sci
- World Lang (12th Unit)
- World Language (All)
- Exceeds 12th Unit

Cultural Diversity

Attributes

- International Cultures (IL)
- United States Cultures (US)

Suffixes

- U: United States Cultures and/or International Cultures and Honors
- Y: United States Cultures and/or International Cultures and Writing Across the Curriculum

General Education

Attributes

- GenEd: Writing/Speaking (GWS)
- GenEd: Quantification (GQ)
- GenEd: Arts (GA)
- GenEd: Health Wellness (GHW)
- GenEd: Humanities (GH)
- GenEd: Natural Sciences (GN)
- GenEd: Social & Beh Sci (GS)
- GenEd Integrative: Interdomain

Suffixes

- N: Inter-Domain
- Q: Inter-Domain and Honors

First-Year Engagement Program

Attribute

- First-Year Seminar

Course Subject

- PSU: First-Year Seminar

Suffixes

- S: First-Year Seminar
- T: First-Year Seminar and Honors
- X: First-Year Seminar and Writing Across the Curriculum

Writing Across the Curriculum**Attribute**

- Writing Across the Curriculum

Suffixes

- M: Writing Across the Curriculum and Honors
- W: Writing Across the Curriculum
- X: Writing Across the Curriculum and First-Year Seminar
- Y: Writing Across the Curriculum and United States Cultures and/or International Cultures

Honors Courses**Attribute**

- Honors

Suffixes

- H: Honors
- M: Writing Across the Curriculum and Honors
- Q: Inter-Domain and Honors
- T: First-Year Seminar and Honors
- U: United States Cultures and/or International Cultures and Honors

Undergraduate Course Lists

Below are links to course lists that contain courses that are approved to satisfy either General Education, Bachelor of Arts, or other University Degree Requirements (e.g., Writing Across the Curriculum, First-Year Seminar, etc.). These lists updated periodically throughout the academic year.

General Education Requirements

- Arts Courses (<https://bulletins.psu.edu/undergraduate/general-education/course-lists/arts/>)
- Health and Wellness Courses (<https://bulletins.psu.edu/undergraduate/general-education/course-lists/health-wellness/>)
- Humanities Courses (<https://bulletins.psu.edu/undergraduate/general-education/course-lists/humanities/>)
- Inter-Domain Courses (<https://bulletins.psu.edu/undergraduate/general-education/course-lists/inter-domain/>)
- Natural Sciences Courses (<https://bulletins.psu.edu/undergraduate/general-education/course-lists/natural-sciences/>)
- Quantification Courses (<https://bulletins.psu.edu/undergraduate/general-education/course-lists/quantification/>)
- Social and Behavioral Sciences Courses (<https://bulletins.psu.edu/undergraduate/general-education/course-lists/social-behavioral-sciences/>)
- Writing and Speaking Courses (<https://bulletins.psu.edu/undergraduate/general-education/course-lists/writing-speaking/>)

Bachelor of Arts Degree Requirements

- Arts Courses (<https://bulletins.psu.edu/undergraduate/general-education/course-lists/ba-arts/>)
- Humanities Courses (<https://bulletins.psu.edu/undergraduate/general-education/course-lists/ba-humanities/>)

- Natural Sciences Courses (<https://bulletins.psu.edu/undergraduate/general-education/course-lists/ba-natural-sciences/>)
- Quantification Courses (<https://bulletins.psu.edu/undergraduate/general-education/course-lists/ba-quantification/>)
- Social and Behavioral Sciences Courses (<https://bulletins.psu.edu/undergraduate/general-education/course-lists/ba-social-behavioral-sciences/>)
- World Cultures Courses (<https://bulletins.psu.edu/undergraduate/general-education/course-lists/ba-world-cultures/>)
- World Language (12th Unit) Courses (<https://bulletins.psu.edu/undergraduate/general-education/course-lists/ba-world-language-12th-unit/>)
- World Language (All) Courses (<https://bulletins.psu.edu/undergraduate/general-education/course-lists/ba-world-language-all/>)
- Exceeds 12th Unit of World Language Courses (<https://bulletins.psu.edu/undergraduate/general-education/course-lists/ba-exceeds-12th-unit-world-language/>)

Other University Degree Requirements

- First-Year Seminar (<https://bulletins.psu.edu/undergraduate/general-education/course-lists/first-year-seminar/>)
- International Cultures (IL) (<https://bulletins.psu.edu/undergraduate/general-education/course-lists/international-cultures/>)
- United States Cultures (US) (<https://bulletins.psu.edu/undergraduate/general-education/course-lists/united-states-cultures/>)
- Writing Across the Curriculum (<https://bulletins.psu.edu/undergraduate/general-education/course-lists/writing-across-curriculum/>)

Course Credits

In accordance with Senate Policy 42-23 (<https://senate.psu.edu/policies-and-rules-for-undergraduate-students/42-00-acquisition-of-credit/#42-20>), for the typical student, a total of forty-five (45) hours of work planned and arranged by the University faculty is required to gain 1 credit. While the distribution of time varies from course to course, generally one-third of the time is devoted to formal instruction and two-thirds of the time to outside preparation. Course credit by instruction may be achieved by a variety of educational experiences that allow the student to work toward mastery of the course objectives. With the acknowledged goal of educational excellence, more than the minimum established here may be required for mastery of course objectives.

The number of credits for each course is indicated in parentheses and can be earned with classroom, practicum, or laboratory work as designated in LionPATH.

A department may schedule an entire section in an undergraduate course for fewer credits than the maximum authorized. In 400-level courses, a department may schedule an individual student for fewer credits than the maximum authorized. In no case, however, may the course be scheduled for 0 credit, or may the total credits scheduled for any student exceed the maximum number authorized for the course.

Repeatable and Variable Credit Courses

Some courses are designated as repeatable; they may be taken more than once for credit. These courses may be repeated indefinitely unless the department stipulates a maximum number of credits allowed. These courses appear with the maximum number of credits allowed following

the number of credits for the course—for example (1.5 credits/maximum of 3).

Courses may have variable credits, such as (1-3), (2-6), or (3-10). Here, the larger number signifies the total credits that can be accumulated for the course over an indefinite number of semesters, unless otherwise specified. For example, a course listed with (1-6) could be taken six semesters for 1 credit each semester, or two semesters for 3 credits each semester, or once for 6 credits, etc.

In some courses with variable credits, students may be permitted to accumulate more than the larger number shown. Such courses will be listed as, for example, (1-3 per semester, maximum of 12).

Any special departmental limitations are indicated by footnotes.

Prerequisites, Concurrent Courses, Co-requisite Courses, and Recommended Preparation

See also: Senate Policy 34-60 (<https://senate.psu.edu/policies-and-rules-for-undergraduate-students/34-00-course-scheduling/#34-60>).

Prerequisites, concurrent courses, and co-requisite courses approximate the necessary specific coursework or general academic knowledge, background, or semester classification required to succeed academically in a given course.

- Prerequisites are courses or other requirements that must be completed prior to the start of a given course.
- Concurrent Courses are similar to prerequisites except that they may be taken prior to, or in the same semester as, the given course.
- Co-requisite Courses are pairs of courses required to be taken together in the same semester.

Registration in a given course is limited to students who have satisfied the stated prerequisite, concurrent, or co-requisite requirements. The course instructor has the right to permit students to take the course without having the stated prerequisite, concurrent, or co-requisite requirements, if the student demonstrates mastery of the material through some other means.

Recommended Preparation relates to preparatory skills or companion courses deemed useful, but not necessary, for successful completion of a course. Recommended preparation has no bearing on registration in a given course.

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Accounting (ACCTG)

ACCTG 501: Research Methods in Accounting

3 Credits

An introduction to the methods and techniques of contemporary research in accounting.

Prerequisite: ACCTG507, a course in statistical inference

ACCTG 502: Accounting Research and Analysis

3 Credits

This course prepares DBA students to consume and produce accounting research. Students will also be equipped with a solid understanding of the philosophy of science and know how to design a research study to avoid common threats to validity. Students will also be instructed on the proper etiquette they should employ when serving in the academic community-especially as it pertains to scholarly peer reviews.

ACCTG 512: Financial Accounting Theory and Reporting Problems

3 Credits

Measurement and reporting of financial information for external purposes, with particular attention to current problems in asset and income measurement.

Prerequisite: ACCTG511

ACCTG 524: Managerial Accounting

3 Credits

CONCEPTS AND TECHNIQUES OF ACCOUNTING FOR PLANNING, CONTROL, AND MOTIVATION.

Prerequisite: ACCTG511

ACCTG 566: Corporate Disclosure in the Capital Markets

3 Credits

ACCTG 566 provides a broad perspective of accounting that spans beyond the Generally Accepted Accounting Principles (GAAP) by exploring the role of financial accounting (and more broadly, corporate disclosure) in the capital markets. This includes discussions about (i) how accounting information flows in the capital markets and why it is so crucial to a well-functioning economy, (ii) key capital market stakeholders, their incentives, and their relation with corporate disclosure, (iii) various disclosure types and venues and their decision usefulness, (iv) the role of corporate governance in ensuring the provision of useful accounting information, (v) earnings management types, incentives, and settings, (vi) the standard setting process, and (vii) the role of emerging technologies in shaping corporate communications with the market. The course will also expose students to the history of accounting to provide insight into how and why accounting has morphed into its current state. Finally, throughout the course, there will be discussion and tie-ins to academic research on capital markets with an emphasis on corporate disclosure research.

Prerequisite: ACCTG 472, BA 840

ACCTG 573: Topics in Financial Reporting

3 Credits

This course examines the accounting for complex business transactions with an emphasis on understanding the "why", rather than exclusively the "how". There is a focus on the economic substance of transactions and developing a deep understanding of the Financial Accounting Standards Board Conceptual Framework. This enables one to analyze the consistency of current financial reporting standards within a conceptual framework while considering alternative accounting treatments that can better reflect the economic substance of transactions. An overview of the conceptual and practical issues surrounding the accounting for investments, fair values, business combinations, consolidation of financial statements, structured transactions, derivatives, and hedging activities and foreign operations will also be covered with the intent for developing an awareness of academic research related to the economics of and accounting for complex business transactions.

Prerequisite: ACCTG 472

ACCTG 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

ACCTG 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

ACCTG 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

ACCTG 597C: **SPECIAL TOPICS**

2-4 Credits

ACCTG 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

ACCTG 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

ACCTG 800: Financial and Managerial Accounting

3 Credits

The purpose of this course is to prepare students to interpret, evaluate, and use both financial and managerial accounting information. Accounting information can be used to evaluate an organization's financial position, to plan future activities (both short-term and long-term), to motivate behavior, and to evaluate performance. The course also focuses on corporate governance and ethical issues.

ACCTG 801: Tax Law and Policy

3 Credits

This course will provide an overview of domestic and international tax policy issues by examining applicable tax reforms, theories of tax law, and interdisciplinary topics. This course will focus on the taxation of individuals including applicable requirements, deductions, and consequences. Additionally, this course will examine relevant tax issues in relation to divorce proceedings, settlement agreements, attorney fees, and sales.

ACCTG 802: Topics in Corporate and Tax Law

3 Credits

This course is designed to teach students about the federal income taxation of corporations and provide an overview of federal estate and gift taxation law. Half of the course will be allocated to topics in federal income taxation of corporations and half of the course will be allocated

to topics in federal estate and gift taxation. This course will deepen students' understanding of taxed corporate entities by focusing on topics such as mergers and acquisitions; bankruptcy; corporate tax reform; and tax exemption among other topics. Additional topics covered will include valuation; power of appointment and revocation; and tax exclusions and deductions (marital and charitable).

ACCTG 803: Forensic Accounting and Litigation Support

3 Credits

Study of investigative accounting, consulting and litigation support activities undertaken in forensic accounting engagements.

Prerequisite: ACCTG403W and ACCTG472 Prerequisite or concurrent: ACCTG881

ACCTG 804: Data Analytics in the Accounting Profession

3 Credits

ACCTG 804 provides Master of Accounting in Accounting Analytics (MAA) students with knowledge designed to prepare them for entry-level positions in the rapidly-evolving field of Accounting. The course will give students an overview of basic programming tools and techniques that can scale to larger data sets, specifically related to financial information and reporting systems, and decision making by both entities and individuals. The course will include an overview of the Python programming language, with a focus on Python modules that are relevant for basic data analytics. The course will also provide students with a comprehensive understanding of the Extract-Transform-Load process, including processes related to obtaining data, cleaning data, visualizing data, and analyzing data. The course will also include an overview of blockchain technology as it relates to the Accounting profession. An introduction to the ethical use of data will also be provided during the course.

ACCTG 805: Applied Accounting and Financial Analytics

3 Credits

ACCTG 805 impounds knowledge gained from prior coursework and serves as the culminating experience for students enrolled in the Master of Accounting in Accounting Analytics (MAA) program. This course provides an advanced application of the Python programming language to the analysis of large-scale datasets which lie at the intersection of accounting and finance. Students will build upon prior work with the Python programming language and acquire more advanced syntax and building blocks for use in Python. They will also build upon prior work with the Extract-Transform-Load process and learn how to acquire, import, modify, join, summarize, visualize, and analyze datasets in order to better understand the relationships between accounting information and capital markets such as how stock prices respond to earnings information, what financial statement information best predicts accounting irregularities, and how eXtensible Business Reporting Language (XBRL) can be harnessed to make more uniform comparisons across companies. Prior work with designing and using relational databases will be enhanced in this course, with a continued emphasis on using data in an ethical manner. The course will be structured around hands-on programming sessions and accompanied by individual assignments to gauge students' mastery of the Python language and multiple projects built around using data to gain insights about the real-world relationships between accounting information and capital

market outcomes. Specific topics will vary based on current issues and instructor interest.

Prerequisite: ACCTG 804

ACCTG 806: Taxes and Business Planning

3 Credits

Effects of tax regimes on decision-making, tax planning and market outcomes. Also, ethics, tax research, and policy.

Prerequisite: ACCTG405

ACCTG 811: Financial Accounting

3 Credits

Accounting rules, practices and applications that characterize the accounting presentations that for-profit organizations provide to the public. ACCTG 811 is part of a series of four accounting courses designed to provide students with the core accounting knowledge needed for an accounting career in industry. This course introduces students to the basic principles, procedures, and objectives of financial accounting that govern the reporting of information about a business to individuals, institutions and other external groups. Course content focuses on: upon (1) conveying the conventions and institutional framework that define accounting rules and practice, including basic exposure to Generally Accepted Accounting Principles; (2) developing familiarity with financial statements; (3) teaching fundamental accounting transactions; and (4) training students in rudimentary analysis of the financial statements.

ACCTG 812: TAXATION

3 Credits/Maximum of 999

Introduction to U.S. federal income tax, covering the basics of taxation of individuals, corporations, flow-through entities and property transactions. ACCTG 812 is part of a series of four accounting courses designed to provide students with the core accounting knowledge needed for an accounting career in industry. This course introduces students to the U.S. federal income tax system. It discusses the pervasive nature of taxation in the U.S. economy and teaches students how to recognize major tax issues, with an emphasis on understanding how they impact economic decision-making. Course content focuses on: (1) developing familiarity with the tax research process and the basic principles of tax planning, (2) the taxation of individuals, and (3) the taxation of business entities including corporations and partnerships.

Prerequisite: ACCTG 811

ACCTG 813: Auditing

3 Credits/Maximum of 999

Principles of the risk-based approach to the audit of financial statements, with special focus on financial information systems.

Prerequisite: ACCTG 811

ACCTG 814: Managerial Accounting

3 Credits/Maximum of 999

Examination of the internal organizational accounting procedures that establish accountability within organizations.

Prerequisite: ACCTG 811

ACCTG 821: Analysis and Interpretation of Tax Law

3 Credits

ACCTG 821 provides accounting and law students who are interested in the practice of taxation with an overview of U.S. federal income tax system research. The course focuses on resolving tax law questions in support of economic decision making and tax return position defense. Students learn to conduct and document in-depth legal research and analysis within the domain of tax law. This writing intensive course hones students' writing skills within the domain of tax law and business decision making. Additionally, the course provides an in-depth understanding of the ethical constructs that guide and limit the practice of taxation.

Prerequisite: ACCTG 405

ACCTG 822: Corporate Taxation and Financial Reporting

3 Credits

ACCTG 822 provides accounting students with knowledge about the taxation of corporations. The course focuses on the tax law treatment of corporate formations, operations, distributions, mergers, and acquisitions. Additionally, students learn about Accounting Standards Codification Topic 740–Income Tax, planning for corporate structure classification, and related ethical considerations.

ACCTG 823: Taxation of Pass-Through Entities

3 Credits

ACCTG 823 provides accounting students who are interested in the practice of taxation a survey of the law defining the taxation of pass-through entities including partnerships, S-corporations, limited liability companies, and trusts. The course focuses on the tax law treatment of formation, operations, distributions, mergers, and acquisitions to the entity and its owners. Planning for structure classification and limitations thereof are embellishments to the basic tax law applicable to pass-through entities.

ACCTG 826: International Taxation

1.5 Credits

ACCTG 826 provides Taxation students knowledge about international tax. The course focuses on the United States taxation of income earned by foreign individuals and entities (inbound transactions) as well as the taxation of U.S. taxpayers operating in foreign jurisdictions (outbound transactions). Students will learn to evaluate legal jurisdiction, residency, and income sourcing, along with planning to optimize transfer pricing and income deferral. In addition, the course provides for an in-depth understanding of treaty utilization and the foreign tax credit in order to limit the same income being taxed by multiple jurisdictions as well as analyzing ethical considerations relating to international taxation.

ACCTG 827: State and Local Taxation

1.5 Credits

ACCTG 827 provides Taxation students knowledge about state and local tax. The course focuses on state taxation of entities and individuals, including constitutional restrictions. In particular, students will acquire the knowledge necessary to recommend solutions that are in conformity

with both corporate and personal tax laws. Additionally, the course provides for an in-depth understanding of sales and use tax in order to both promote compliance as well as limit tax exposure to the extent permitted by law.

ACCTG 829: Tax Research and Analysis

3 Credits

ACCTG 829 is the capstone course for students in the M.Acc. in Taxation program, providing a culminating experience near completion of the program. The course focuses on resolving tax law questions in support of economic decision making and tax return position defense. Students learn to conduct and document in-depth legal research and analysis within the domain of tax law. This writing intensive course hones students' communications skills within the domain of tax law and permits students to build on content knowledge learned in other Taxation core courses. Additionally, the course provides an in-depth understanding of the ethical constructs that guide and limit the practice of taxation.

ACCTG 831: Advanced Auditing

3 Credits

The goal of this course is to advance knowledge in contemporary issues in auditing and in auditing research and case analysis. The focus includes implementing the auditing principles, standards, procedures, and practices, and applying them in case analysis. Topics comprise integrated auditing of financial statements and internal controls; continuous auditing; assurance services on nonfinancial information; auditing of computer-based systems; emphasis on auditing software and computer auditing techniques used to evaluate accounting systems controls and test accounting data integrity; forensic accounting and fraud detection; and the nature and use of expert systems in accounting with emphasis on their use as an audit tool.

Prerequisite: ACCT 532, ACCT 550, ACCTG 512, ACCTG 873, BLAW 444

ACCTG 873: Advanced Topics in Financial Reporting

3 Credits

Financial disclosure and reporting for complex business enterprises and activities; current issues in financial reporting.

Prerequisite: ACCTG471 and ACCTG472

ACCTG 881: Financial Statement Analysis

3 Credits

Analysis of financial reports to identify business strategy, assess performance and economic standing, and value claims.

Prerequisite: ACCTG471 and ACCTG472 Prerequisite or concurrent: B A 531

ACCTG 895: Internship

1-6 Credits/Maximum of 6

Supervised, professionally oriented, off-campus, nongroup instruction, including field experiences, practicums, or internships.

ACCTG 897: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject with a professional orientation that may be offered infrequently; several different topics may be taught in one year or semester.

Accounting - CA (ACCT)

ACCT 501: Financial Statement Analysis

3 Credits

Study of financial reporting, financial statement analysis, capital markets, asset pricing and impact of ethical, legal, regulatory and environmental concerns.

Prerequisite: admission to M.B.A. or MS/IS Program

ACCT 504: Auditing Theory and Practice

3 Credits

Auditing theory pertaining to the regulatory environment, risk assessment, internal controls, materiality, computerization, analytical procedures, sampling, fraud, ethics, and professional responsibilities. ACCT 504 Auditing Theory and Practice (3) This course provides in-depth coverage of the theory and practice of auditing. Topics may include the regulatory environment, risk assessment and planning, internal controls, materiality, computerized auditing, analytical procedures and sampling, accounting fraud, ethics and professional responsibilities. Students are expected to apply professional judgment in practical applications of course concepts, building on technical knowledge acquired in undergraduate accounting coursework.

Prerequisite: ACCTG403

ACCT 510: Business Tax Planning Theory and Practice

3 Credits

Tax theory pertaining to corporations, partnerships and conduit entities, estates, trusts, ethics, and professional tax responsibilities. ACCT 510 Business Tax Planning Theory and Practice (3) This course provides in-depth coverage of the theory and practice of tax planning for corporations, partnerships and other related pass-through entities. Topics will include tax research, corporate formation and capital structure, corporate non-liquidating distributions, corporate acquisitions and reorganizations, consolidated tax returns, partnership formation and operation, special partnership issues, S corporations, taxation of gifts, estates and trusts, and professional responsibilities and ethics.

ACCT 532: Accounting Information and Decision Systems

3 Credits

The study of business processes, transactions cycles, and internal control structure with an emphasis on computerized accounting information systems. ACCT 532 Accounting Information and Decision Systems (3) The course includes the study of business processes, transactions cycles, and internal control structure with an emphasis on computerized accounting information systems. The course explores the need for communication of information across functional areas to meet an organization's contemporary auditing, professional and legal considerations. The role of information systems is demonstrated

by a focus on reporting objectives, management needs, transaction trails, documentation, security, internal controls, and the integration of accounting systems in the evaluation and selection of software.

ACCT 540: Accounting for Managerial Decisions

3 Credits

Application of accounting to monitoring and improving the internal operation of an organization. ACCT 540 ACCT 540 Managerial Accounting (3) Accounting is the language of economic activity. Managers in all organizations - business, government, and not-for-profit - use accounting information to make decisions. As such, managerial accounting is an important competency area for MBA graduates. Managerial Accounting addresses resource-related questions from a cost perspective. Relevant issues include resources consumed and the related cost of producing goods and providing services, and the effectiveness and efficiency of resource usage.

Prerequisite: ACCT 501

ACCT 545: Strategic Cost Management

3 Credits

Current managerial accounting topics such as activity-based costing, theory of constraints, performance measures and their use in organizations.

Prerequisite: ACCT 540

ACCT 550: Professional Responsibilities and Ethics in Accounting

3 Credits

The study of ethical systems and ethical decision making and their application in Accounting. ACCT 550 Professional Responsibilities and Ethics in Accounting (3) This course provides students with a foundation in professional codes of conduct and ethics adopted by professional associations and licensing boards for accountants, auditors, and fraud examiners. Topics include research into and discussions of selected historical and contemporary ethical cases and issues as they relate to accounting and business. The course includes an introduction to the concepts of ethical reasoning, integrity, objectivity, independence, core values, and professional issues in accounting. The course provides a working knowledge of ethical and justice theories on which students will be able to build as their careers progress. Some of the ethical issues that they may have to address include corporate social responsibility, distributive justice, accounting and economic development, accounting and the environment, professionalism, whistleblowing, and tax avoidance and evasion. Students will gain an understanding of the ethical foundations from which they can address the ethical issues that they will face as a professional.

ACCT 561: Financial Statement Analysis II

3 Credits

The exploration of conventional and advanced methods of analyzing financial statements, including earnings quality and financial distress assessment. ACCT 561 ACCT 561 Financial Statement Analysis II (3) The objective of this course is to explore conventional and advanced analytical methods of analyzing financial statements. Expanding on the material covered in a financial accounting or financial statement analysis course and using actual financial statements, students: ♦ review and apply the traditional methods for analyzing financial statements,

such as ratio analysis, trend analysis, and common-size analysis ♦ apply advanced tools for analyzing financial statements, such as financial distress prediction models and earning manipulation prediction models ♦ evaluate accounting policies and disclosures and their impact on the financial statements through the assessment of earnings quality. Evaluation methods include case studies of actual companies and a comprehensive project to analyze the financial statements of a publicly-traded company. This course typically will be offered once a year.

Prerequisite: ACCT 501

ACCT 572: Financial Reporting I

3 Credits

Accounting theory and practice for reporting consolidations, foreign currency transactions, and preparing financial statements for governmental and NGOs. ACCT 572 Financial Reporting I (3) This course covers accounting theories and procedures as they pertain (a) to the preparation of financial statements for consolidated entities, (b) to the use of foreign currency and (c) to the financial reporting of activities of governmental and of not-for-profit entities. Contemporary reporting issues are reviewed and explored. This course may utilize textbooks, lectures and/or cases. It is guided by financial reports. It explores the means of preparing certain financial statements and the ways of interpreting them. This course is recommended for students who did not take Advanced Accounting and/or Governmental Accounting at the undergraduate level.

Prerequisite: ACCTG472

ACCT 573: Financial Reporting II

3 Credits

Topics involving consolidated financial statements, special purpose entities, derivative financial instruments, and use of the Financial Accounting Research System (FARS). ACCT 573 Financial Reporting II (3) This course covers (a) advanced topics related to the preparation of consolidated financial statements, (b) accounting for derivative financial instruments, (c) accounting for off-balance sheet financing and special purpose entities, and (d) the use of the Financial Accounting Research System (FARS) to explore advanced financial reporting issues. This course relies upon textbooks-based, lecture-based, and case-based learning. It is guided by financial reports. It explores the means of preparing certain financial statements and the ways of interpreting them. It is assumed that students taking this course have either completed ACCT 572 or have completed courses providing significant coverage of consolidations, foreign currency transactions, governmental accounting and not-for-profit accounting at either the undergraduate or graduate level.

Prerequisite: ACCTG572

ACCT 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

ACCT 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including research and design, that are supervised on an individual basis and which fall outside the scope of formal courses.

ACCT 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given infrequently to explore, in depth, a comparatively narrow subject which may be topical or of special interest.

ACCT 834: Information Technology (IT) Auditing

3 Credits

This course centers on auditing elements of the information technology environment that are required for any financial or operational audit that is significantly dependent on computerized systems. This course exposes students to the key areas of IT auditing - security, system development, operations including business resilience - using a risk management and controls approach. The course helps students develop the ability to evaluate automated and manual controls within the IT infrastructure for potential impacts on critical attributes like confidentiality, availability, and privacy. Control failures will be covered to highlight the unique judgment decision making paradigm that auditing brings to the operation of the IT control environment. Finally, the IT related frameworks and regulations that exist within the United States will be examined.

Concurrent: ACCT 504

Acoustics (ACS)

ACS 501: Elements of Acoustics and Vibration

3 Credits

Vibrational acoustics including mechanical oscillation, forced and damped response, vibration of strings, membranes, rods, bars, and plates. ACS 501 Elements of Acoustics and Vibration (3) Acoustics is a broad subject that crosses and interacts with many engineering, science, mathematics, medical, and artistic disciplines. This course provides a thorough foundation necessary for studying structural acoustics and vibration problems and the exploration of acoustic waves in solids. A detailed analysis of the single-degree-of-freedom mechanical mass-spring system provides the building block for exploring lumped-element models of more complicated acoustic systems and the phenomena of resonance for forced and damped systems. Multiple-degree-of-freedom mechanical systems are used to investigate the coupled oscillation between oscillating systems, the design of vibration absorbers, and methods for modeling the low frequency behavior of guitars, violins, and vented-boxed loudspeakers. Extending the mass-spring model to an infinite number of degrees-of-freedom leads to a development of the wave equation and its solutions for longitudinal acoustic waves in elastic solids. Boundary conditions and the concept of mechanical impedance are used to explore standing waves in a bounded elastic medium and the transmission of waves between media with different elastic properties. Transverse waves on an elastic string, while fundamentally different from longitudinal waves, obey the same differential equation of motion and the same application of boundary conditions and mechanical impedance. For both longitudinal and transverse wave systems, the mechanical impedance approach and the method of separation of variables are used to study systems with specified boundary conditions. Longitudinal and

transverse waves in structures with varying cross-section, density, or elastic properties are also explored. Torsional waves in elastic solids are explored with application to systems with various cross-sectional shapes. Membranes serve as a two-dimensional extension of transverse waves on an elastic string, and provide mode shapes which may be described using rectangular and cylindrical coordinates (with Bessel function solutions). The fourth-order differential equation of motion for flexural bending vibrations of thin beams is derived and solutions are explored using the separation of variables approach for boundary value problems. Finally, the flexural vibration of two-dimensional rectangular and circular plates are investigated. Homework problem sets will illustrate theory and applications to real world problems.

ACS 502: Elements of Waves in Fluids

3 Credits

Thermodynamic and hydrodynamic foundations of linear acoustics in fluids with applications to lumped-elements, reflection, refraction, radiation, attenuation, enclosures, and waveguides. The purpose of this course is to provide the foundation for understanding the behavior of waves in fluids in the "linear acoustic" limit for first-year graduate students entering the Graduate Program in Acoustics. The course provides a common ground for students coming from a broad range of varying undergraduate programs in sciences, engineering, mathematics, and the arts. This self-consistent foundation will be built upon an understanding of thermodynamics and the consequences for the behavior of gases and gas mixtures (i.e., ideal gas equations-of-state, heat capacity), and hydrodynamics (both dissipative and non-dissipative) as expressed from the Eulerian perspective. This perspective will be used to develop techniques for understanding oscillations in lumped-element acoustical networks that are smaller than the wavelength of sound and will be applied to extended media in which waves propagate, are reflected and transmitted through interfaces between media with different acoustical properties, and are refracted through media with continuously-varying acoustical properties. The same equations will be applied to the excitation of sound waves that propagate in 3-dimensions by vibrating bodies that are smaller than the wavelength of sound. Those results will be extended by superposition of such "compact sources" to produce both discrete and continuous one- and two-dimensional arrays. The directional properties and strength of such extended sources will be examined. The behavior of sound within 3-dimensional rectangular enclosures is studied via the method of "separation of variables" to identify the sound modes in such enclosures, their characteristic frequencies, and the selective excitation and detection of such modes. The frequency dependence of the density of modes is introduced to motivate the relationship between the modal and raytracing (i.e., ballistic) perspectives. The techniques of "statistical energy analysis" will be applied such enclosures to quantify architectural phenomena such as reverberation time and critical distance. Those results will be extended to non-rectangular enclosures and to rectangular and cylindrical waveguides, focusing on the concept of group and phase speed and the coupling of sources to planewave and higher-order waveguide modes. Attenuation of sound waves is also treated from the hydrodynamic perspective and results are derived for boundary-layer dissipation, classical thermoviscous sound absorption within bulk fluids, and the relaxation-time approximation is applied for sound absorption by chemical association-dissociation in seawater and the effects of humidity on collision-times in air. Problem sets that illustrate the theory and applications are a central component of this course.

ACS 503: Signal Analysis for Acoustics and Vibration

3 Credits

This course will provide students with an in-depth treatment of time/frequency analysis of acoustic or vibration signals with direct connection to physical measurements. Students will build an awareness of the various techniques of signal analysis and a proficiency with these techniques and the language of signal analysis, skills that will facilitate their independent reading and learning beyond this course. Students will develop their ability to check answers for validity. Applications will be discussed in the context of actual measurements as students explore the implications and limitations of conventional techniques as applied to real signals in the background of real noise. Building on these insights, the students will demonstrate proficiency in the application of the techniques of signal analysis using common analysis-software packages and will develop proficiency in interpretation of the results.

ACS 505: Experimental Techniques in Acoustics

2 Credits

Properties of acoustical and vibrational transducers, electronic and other instrumentation used in fundamental data measurement, acquisition and analysis.

Prerequisite: ACS 501 , ACS 502

ACS 513: Digital Signal Processing

1-3 Credits

Discrete linear systems, transforms, digital filter design and applications, discrete fourier transforms, spectrum analysis.

ACS 514: Electroacoustic Transducers

3 Credits

The theory, design, and calibration of passive, linear, reciprocal electroacoustic transducers for use in both air and water media.

Prerequisite: PHYS 443

ACS 515: Acoustics in Fluid Media

3 Credits

Wave propagation in stationary and moving fluids; acoustic radiation and scattering; standing waves in ducts and cavities.

Prerequisite: E MCH524A ; PHYS 443

ACS 516: Acoustical Data Measurement and Analysis

2-3 Credits/Maximum of 3

Presents the engineering applications of recent developments in correlation and spectral analysis to acoustical measurement problems.

ACS 519: Sound-Structure Interaction

3 Credits

Acoustic radiation from and effects of fluid-loading on vibrating infinite and finite plates and shells. Acoustic transmission through and reflection

from elastic plates and shells, acoustic excitation of elastic plates and coupling between panels and acoustic spaces.

Prerequisite: ACS 501 , ACS 502 , E MCH524B

ACS 521: Stress Waves in Solids

3 Credits

Recent advances in Ultrasonic Nondestructive Evaluation: waves; reflection and refraction; horizontal shear; multi-layer structures; stress; viscoelastic media; testing principles.

Prerequisite: E MCH524A , E MCH524B

Cross-listed with: EMCH 521

ACS 523: Signal Analysis for Acoustics and Vibration II

3 Credits

This course is concerned with the time and frequency-domain analysis of discrete-time signals and discrete-time linear systems, with an emphasis on developing and applying analysis techniques with applications in acoustics and vibrations. In this course, students will learn how to apply amplitude and frequency modulation to signals, evaluate the stability and causality of systems, extract features from measured acoustic signals, and design and use common filters (i.e. infinite impulse response, finite impulse response, adaptive, and tracking).

Prerequisite: ACS 503

ACS 524: Transducers II and Acoustics System Modeling

3 Credits

The course covers current research in the design analysis and performance prediction for acoustic transducers and acoustical systems that include transducers. Examples of such systems are microphones, loudspeakers, piezoelectric sources and sensors, and systems that include one or more of these devices. This course builds on the understanding developed in ACS 514 to synthesize knowledge necessary for understanding and analyzing the nonlinearities in transducer systems to enable improved designs with reduced distortion or compensation for nonlinear behavior.

Prerequisite: ACS 514

ACS 530: Flow-Induced Noise

3 Credits

Introduction to the basic and applied aspects of flow-induced noise created by subsonic flows of various complexities. ACS 530ACS 530 Flow-Induced Noise (3) The objective of this course is to introduce the basic and applied aspects of flow noise created by subsonic flows of various complexities. Basic concepts of noise and pressure fluctuations induced by unsteady fluid flows are discussed, including theoretical as well as experimental approaches. For a given class of flow, mechanisms for the creation of unsteady wall pressures and forces, radiated sound, and fluid-structure interactions are detailed. Various prediction schemes are presented which range from purely theoretical to empirical. The intent is to keep the material practical while at the same time introducing the student to a wide variety of specific topics. Some of the topics to be presented include: basic fluid mechanics, fundamental flow noise theory, flow noise measurement issues including wave vector-frequency spectral estimates of unsteady pressures and forces, compact

Green's functions, unsteady forces and noise created by bluff bodies in flow, vortex shedding noise, wall pressure fluctuations and acoustics associated with turbulent boundary layers, including separated layers and transition zones, unsteady forces and noise due to flow over lifting surfaces, edge acoustic scattering mechanisms, axial-flow fan noise, rotor/flow interactions, turbulence ingestion, centrifugal blower noise, and noise generated by flow in pipes. The prerequisite for this course is a solid understanding of the fundamentals of acoustics, as demonstrated by successful completions of ACS 501 and 502. Students with a minor in Acoustics from accredited universities may also have the proper background to take this course. Although basic fluid mechanics is covered in the course, any previous courses or experience in this area will be beneficial. Homework problems will be assigned weekly and graded. Some of the homework may involve reading technical papers and providing a written synopsis. The average of all homework grades will constitute one-third of the final course grade. Another third will come from the mid-term exam and the final third from the final exam.

Prerequisite: ACS 501 and ACS 502

ACS 537: Noise Control Engineering I

3 Credits

As the first of three courses, this course provides an orientation to the program and covers fundamentals of noise control. ACS 537 Noise Control Engineering I (3) This course will introduce students to the application of acoustic and vibration fundamentals to the analysis and reduction of noise and vibration problems in industrial and residential settings. Topics will include: source-path-receiver model, human hearing and psychoacoustics, human response to noise and vibration, sound quality metrics and criteria for quantifying noise, acoustic standards related to noise and vibration control, instrumentation for measuring and analyzing noise and vibration, noise sources (distributed sources, impact sources, flow noise), absorption (materials, measurement, placement), control of sound in large and small rooms, partitions and barriers, mufflers, and vibration control techniques. Homework will combine problem solving with analysis of case studies. Group projects may be used to encourage collaborative approaches to problem solving.

Prerequisite: BS in engineering or related field, or instructor approval

ACS 542: Physical Principles in Biomedical Ultrasonics

3 Credits

Physical principles of advanced ultrasonic imaging and quantitative data acquisition techniques in fields of biology and medicine. E MCH (ACS) 542 Physical Principles in Biomedical Ultrasonics (3) This course focuses on the phenomenon of ultrasound in the context of medical and biological applications, systematically discussing physical principles and concepts. Concepts of wave acoustics are examined and practical implications are explored - first, the generation and nature of acoustic fields and then their formal descriptions and measurement. Real tissues attenuate and scatter ultrasound in ways that have interesting relationships to their physical chemistry, and the course includes coverage of these topics. This course also includes critical accounts and discussions of the wide variety of diagnostic and investigative applications of ultrasound that are available in medicine and biology. The course encompasses the biophysics of ultrasound and its practical applications to therapeutic and surgical objectives. The course utilizes finite element methods for simulation.

Cross-listed with: EMCH 542

ACS 580: Contemporary Research in Acoustics

1 Credits

Contemporary research activities in acoustics: major research thrusts, including current research methodologies and their limitations.

Prerequisite: ACS 501, ACS 502, ACS 505, ACS 590, ACS 594 or equivalent

ACS 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

ACS 594: Research Topics

1-15 Credits/Maximum of 15

Supervised student activities on research projects identified on an individual or small-group basis.

ACS 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

ACS 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

ACS 598: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

ACS 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

ACS 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

ACS 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

ACS 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

Additive Manufacturing and Design (AMD)

AMD 500: Legal Issues in Additive Manufacturing

2 Credits

This course explores the legal rules related to the ownership, enforcement and management of information related to additive manufacturing. It is directed primarily to students working in fields outside of the legal profession. Primary areas of focus include intellectual property ("IP") law (patents, trademarks, copyrights and trade secrets), product liability and cybersecurity law, as well as the legal rules for related industry practices such as licensing. In addition to understanding the legal framework, students will apply the course teachings to develop managerial skills such as: understanding legal contracts and license agreements; protecting company secrets; developing invention and design rights; branding distinctive products and services; designing products in light of tort liability rules; and adhering to best data protection practices.

AMD 501: Statistical Methods for Additive Manufacturing

3 Credits

This course explores the theoretical and practical underpinnings of statistical methods and tools for additive manufacturing (AM). It is primarily directed to engineering students working in fields outside of statistics and data science to design and develop statistical methods and tools for data analytics in AM. The primary areas of focus are statistical methodologies such as statistical process control, statistical design and analysis of experiments, predictive analytics, and reliability modeling. In addition to understanding statistical methodologies, students will apply the course teachings to design and implement the appropriate methodologies to model and analyze AM processes. Through this analysis, students will develop the skills for data-driven manufacturing informatics and decision making. Recommended preparation for the course includes basic concepts on probability and statistics, and the use of computing software (e.g., Matlab or Python).

Recommended Preparation: Basic concepts on probability and statistics, and the use of computing software (e.g., Matlab or Python).

AMD 502: Cybersecurity for Additive Manufacturing

2 Credits

This course explores the intersection of cybersecurity and additive manufacturing (AM) by examining information security, information assurance, design, fabrication, and industrial security to defend AM from emergent threats using current research literature, theory and practical analysis of data and analyses, and provides general methodologies to address cybersecurity principles across a digital manufacturing enterprise. Students will examine networks, quantify assets on the network, determine attack perimeters and vulnerabilities using commonly available network and cybersecurity tools, all while using the theme of advanced manufacturing technologies. Students will analyze current, known attacks and exfiltration of data and how best cyber practices

can help secure and defend the relevant data. Students will recognize how different modalities of sensing and machine parameters can be manipulated to cause harm to the part, the printer, and the process. The course will follow issues concerning intellectual property of the digital manufacturing paradigm; case studies on techniques for attacking and defending design intent; and review recent literature on cyber security within the AM process.

AMD 527: Additive Manufacturing Processes

4 Credits

The course will cover the fundamentals of Additive Manufacturing (AM) processes. During the course the students will leverage their background in computer-aided manufacturing to learn the Digital Work Flow steps from Design to Manufactured AM parts. They will learn and gain experience in the various data representation, algorithms and software tools, processes, and techniques that enable advanced/additive manufacturing. Computational algorithms will be researched and evaluated. Detailed research investigations into the fundamental process models of various additive manufacturing (AM) processes using polymers, metals, and other material will provide insight into the operating principles, capabilities, and limitations of AM processes. In addition to theoretical knowledge, the students will gain hands-on experience with AM machines and understand the complete process steps through design, fabrication, and measurement of example parts. The students will study the range of applications of AM across a spectrum of industries (e.g., aerospace/automotive, medical devices, and consumer products) while developing an understanding of the requirements, constraints, and business case for the applications. After completing this course, students will have a fundamental understanding of the research in AM processes and prepare them for additional depth in follow on courses. Additionally the students will be able to appropriately utilize (e.g., evaluate, select, design) this developing technology in the future of manufacturing and digital transformation of manufacturing.

Cross-listed with: IE 527

AMD 545: Engineering and Scientific Principles of Additive Manufacturing

4 Credits

In additive manufacturing (AM), components are fabricated via sequential joining using a bonding agent, curing, sintering, or fusing. AM fabrication of metals, ceramics, polymers, and organics has been demonstrated and is actively being used in industry and academia. ESC 545 / AMD 545 explores these processes with a focus on the fundamentals of sintering and fusion of metals, ceramics, and polymers. The topic is multi-disciplinary, requiring examination of individual AM system components, the physics of energy-material interactions, and the materials science at play during heat-reheat cycles. Opportunities for process sensing and real-time control are explored, as well as the role of post-process technologies in realizing serviceable components. These topics will lead to a discussion of methods and strategies to optimize component properties and characteristics. Current and potential impacts of AM on society are also covered.

Recommended preparations: A course in engineering materials and/or engineering analysis is highly desired but not required.

Cross-listed with: ESC 545

AMD 562: Design for Additive Manufacturing

4 Credits

Additive manufacturing (AM, colloquially 3D printing) is rapidly changing the face of modern manufacturing. This layer-by-layer manufacturing approach allows for parts to be created with significant levels of complexity and in cost-effective small batches, with reduced raw material waste when compared with traditional manufacturing processes. This technology has given rise to the need for Design for Additive Manufacturing (DfAM) techniques capable of accounting for both the possibilities and restrictions offered by AM in product design. However, due to the relative youth of the technology, understanding of how to properly establish and evaluate these design considerations is still evolving. In this course, students will be exposed to research in the field of DfAM that aims to establish an understanding of both opportunistic possibilities (e.g., lattice structures, topology optimization, and mass customization) and quantify restrictive limitations (e.g., minimum feature size and support material removal) when designing products for creation with additive manufacturing. The material will be presented through a combination of literature investigations and design exercises viewed through the lens of research in the DfAM field. The objectives of the course include describing the role that DfAM plays in the greater field of additive manufacturing, identifying similarities and differences between existing DfAM approaches and frameworks, synthesizing opportunistic DfAM approaches and how they improve product quality and novelty, identifying and quantifying restrictive DfAM considerations through experimentation, and identifying and discussing key areas of future research to advance the field of DfAM.

CONCURRENT: IE 527

Cross-listed with: EDSGN 562

AMD 566: Metal Additive Manufacturing Laboratory

3 Credits

This course will provide in-depth and hands-on laboratory experience in metal-based additive manufacturing. The laboratory activities will expose students to all aspects of the additive manufacturing workflow for metal components, starting with conceptual design, proceeding through fabrication, post-processing, and part inspection. Laboratory activities will include part design and analysis, process simulation and modeling, build preparation and machine set up, fabrication and post-processing, and non-destructive inspection and measurement. Laboratories will include computational design tools and simulation models as well as fabrication and post-processing (e.g., heat treatment, machining). Finally, the laboratory activities will also stress safe powder handling, equipment, and laser safety, which is particularly important when working with metallic powders and feedstocks. The laboratory is intended for students that have a basic understanding of the different additive manufacturing processes and are gaining familiarity with the engineering and science of additive manufacturing. The laboratory activities will provide students with the scientific foundation and research skills necessary to rigorously ascertain the performance of additively manufacturing materials, processes, and parts. Upon completion of the laboratory, students should be able to describe the workflow for additive manufacturing, identify main cost drivers, and describe the differences when using metals versus polymers. They should also understand the key tradeoffs between design, manufacturing, and materials as it relates to the additive manufacturing processes utilized in the laboratory activities.

Recommended Preparation: This course is intended for students that have a basic understanding of the different additive manufacturing

processes and are interested in gaining familiarity with the engineering and science of additive manufacturing

Cross-listed with: ME 566

AMD 567: Additive Manufacturing of Metallic Materials

3-4 Credits

This course will expose students to the state of the art in understanding processing, structure, and property relationships in materials fabricated using additive manufacturing (AM). There will be a strong focus on metallic alloys, but polymers, ceramics, and advanced materials will also be briefly discussed. The emphasis of the course will be on understanding the links between processing and the resulting structure, as well as the microstructure and the mechanics of the fabricated materials. Initially, we will discuss the types of AM and the feedstock materials required for these processes. We will then focus on metals, and discuss the energy sources used in AM (lasers, electron beams), and their interactions with the material. We will discuss the molten pool characteristics and the solidification microstructures. We will relate the microstructures seen in AM to the resulting mechanical properties (elastic deformation, plastic deformation, fracture, fatigue performance, and residual stress/distortion). Finally, we will discuss specific case studies for metals, polymers, ceramics, and advanced materials.

Cross-listed with: MATSE 567

AMD 575: Aerospace Materials

3 Credits

Advanced materials are critical to improve performance, safety, and sustainability of air flight and space exploration in extreme environments. This course provides a survey of engineering knowledge on existing and future advanced materials for aerospace applications, and provides multiple opportunities for students to apply this knowledge and to analyze existing tailored aerospace materials of high performance. First, class participants will review the origins of the material properties: atomic bonding and packing, grains and boundaries, interfaces/interphases, and micro-structuring. Second, the participants will learn about common aerospace materials (metal alloys, ceramics, and polymer composites); how these materials satisfy the tight performance requirements and withstand extreme environments. Third, novel material design (nanocomposites and metamaterials), mostly in the nano and micro scales, and how their micro-structures drive their advanced properties will be discussed, together with their current challenges in applications (material design, scalable fabrication, and certification).

Prerequisites: AERSP 470 or ME 560 Recommended Preparations: Students should have knowledge on solid works (stress-strain constitutive relations, coordinate transfer, etc.), basic undergraduate-level math for engineering majors (ODE, matrix calculation, Cross-listed with: AERSP 575

AMD 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

AMD 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including non-thesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

AMD 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given infrequently to explore, in depth, a comparatively narrow subject which may be topical or of special interest.

AMD 600: Thesis Research

1-15 Credits/Maximum of 999

Thesis Research

Adult Education (ADTED)

ADTED 501: Foundations of Medical Education

3 Credits

This course provides an overview of medical education, and considers how it operates as a specific form of adult education. ADTED 501 Foundations of Medical Education (3) The primary focus of this course is to explore the foundations of medical education by providing an overview of medical education, and considering how medical education operates as a specific form of adult education. It is especially relevant to educators working with adult learners in medical education, nursing education, or health education. More specifically, the course will focus on how insights from adult learning theory can contribute to the theory and practice of medical education in designing curriculum and developing an appropriate pedagogy in both classroom and clinical teaching contexts. It will examine recent and future trends in US medical education in light of the context of: the guidelines of the American Association of Medical Colleges (AAMC); the current health care system; and comparative trends in medical education in other countries. The course will examine research in medical education, and help students focus on the connections of research and educational philosophy/theory with developing their own teaching practice in medical education in classroom settings (face to face and online), and in clinical teaching settings. Finally, it will briefly explore trends in medical education assessment, and issues in continuing medical education. Objectives are: 1. To provide an overview of the foundations of Medical Education as Adult Education 2. To consider the development of medical education in light of its history and recent trends in health care in both a U.S. and international context 3. To analyze and discuss adult learning theory as related to medical education in both classroom and clinical settings 4. To examine some of the research in medical education assessment strategies used in evaluating medical education 5. To develop a philosophy of medical education that guides the development of curriculum and pedagogy in different medical education settings 6. To develop specific strategies for medical education teaching practice for both classroom and clinical contexts In addition to ongoing participation, evaluation is predominantly based on the following: 1. A paper where students discuss their philosophy of medical education and what it suggests for curriculum development in light of course readings and class discussion 2. A collaborative book review and presentation of a recent book in medical education 3. A final paper or project exploring an issue in medical education in depth

Prerequisite: ADTED460

ADTED 502: Program and Instructional Design in Medical Education

3 Credits

This course focuses on program planning and instructional design in a medical setting with an emphasis on teaching with simulation. ADTED 502 Program and Instructional Design in Medical Education (3) Participants of this course will explore a variety of program and curriculum planning and instructional design approaches to teaching in a medical setting, with a particular emphasis on the use of simulation as an instructional design. Program planning is informed by models from the adult education literature and curriculum planning informed by the field of medical education which will provide a framework for preparing participants in the assessing, planning, developing and evaluating simulations as an instructional design. The course will provide participants with the both theoretical understanding and direct practical experience so they are able to effectively plan and develop effective simulations for teaching in a medical setting. In addition, this course is taught in six sessions (9-5pm) which is a suitable format for teaching the content and the work schedule of medical students/faculty who will be taking this course.

Prerequisite: ADTED460

ADTED 505: The Teaching of Adults

3 Credits

Examination of direct and indirect teaching; contracts, application of current technology, andragogy, motivation, evaluation; knowledge of research.

Prerequisite: ADTED460

ADTED 506: Program Planning in Adult Education

3 Credits

Intensive study of theoretical foundations, policies, evaluation models, methods, and materials in program planning in adult education.

Prerequisite: ADTED460 , ADTED505

ADTED 507: Research and Evaluation in Adult Education

3 Credits

Guided discussion and reading in selected research and evaluation methods and trends as applied in adult education settings.

Prerequisite: ADTED460 ; introductory statistics course; introductory research design course

ADTED 508: Globalization and Lifelong Learning

3 Credits

Examination of globalization discourses and their relationships, implications and impacts on lifelong learning processes and contexts. ADTED 508ADTED (CI ED) 508 Globalization and Lifelong Learning (3) The course is designed to help students to critically examine the nature and impacts of globalization on lifelong learning. The main goal is to enhance the students' ability to learn and work in a globalizing world and to challenge traditional perspectives about globalization and lifelong learning. As such, the course will adopt a critical perspective on

globalization while helping the students to develop a reflective stance on the theory and practice of lifelong learning. A central focus of the course will be to develop a critical analysis that contributes to the building of a more active and socially responsible adult learner. Students will be evaluated using a number of assignments/projects. The major research paper, class presentation, two critiques of theories of lifelong learning, country profile of lifelong and a short reaction paper will count for 90% of the course grade. Class participation will be awarded 10%.

Cross-listed with: CIED 508

ADTED 509: Language, Literacy, Identity, and Culture in a Global Context

3 Credits

Examines the relationship between issues of language, identity and culture for adult learners in an increasingly global context. ADTED 509 ADTED (CI ED) 509 Language, Literacy, Identity, and Culture in a Global Context (3) This core required course provides graduate students in the ADTED Ph.D. program a critical overview of the literature, theories, and scholarship examining the complexities inherent in an increasingly diverse global and post-colonial sphere. Explorations of historical, theoretical, postcolonial perspectives will be the focus, as will the daily portrayals of diverse peoples by the media. Participants in the course will be expected to familiarize themselves with the readings portraying the complexities of ethnicity, indigeneity, race, gender, and social class. Evaluation will focus primarily on writing a scholarly paper, preparing video materials that illustrate the issues, writing their personal educational histories, and participating in class.

Prerequisite: ADTED508

Cross-listed with: CIED 509

ADTED 510: Historical and Social Issues in Adult Education

3 Credits

Social and historical foundations of adult education in the United States and selected nations.

Prerequisite: ADTED460

ADTED 515: Foundations of Educational Research

3 Credits/Maximum of 999

Students read the philosophical foundations of education research, study how philosophies influence methodologies, and analyze current educational problems. This course is designed for students entering doctoral programs in the College of Education. Our students are studying to become education researchers within a highly politicized environment. For example, particular definitions of education research and government policies that favor some types of research practices over others provide opportunities for and set limits upon the work of education researchers. Public controversies likewise contribute to challenges faced by education researchers who find their work affirmed or discounted by particular definitions and policies. In order to explore these controversies and to allow students to begin identifying their own "positionality" with regard to research, this course begins with a reading of the history and philosophies of education research (primarily focusing on the United States). The course goals are: - to identify underlying assumptions of competing forms of social inquiry, each determined to uncover new knowledge; - to bring those assumptions to bear on education research in chosen fields of study; and - to begin to develop one's own positions in order to direct further study and research. Specifically, through instructor

facilitation and group discussions, students will come to understand major philosophical perspectives that permeate and drive research methodologies in education: positivism, postpositivism, interpretivism, critical theory, poststructuralism, and pragmatism. These understandings allow students to recognize the methodological assumptions that inform published research studies and to discover how methodologies might inform the research they wish to conduct as students and practitioners. Although the course is not required by any particular doctoral program in the College of Education, it is suggested for students who consider research important to their future careers and who see benefits in exploring the methodological options available.

Cross-listed with: CI 515, EDPSY 515, HIED 515

ADTED 521: Doctoral Proseminar

3 Credits/Maximum of 999

An orientation to the field of adult education and to doctoral study in the Adult Education Program at Penn State. This course provides both an orientation to the field of adult education as an area of study and an initial seminar for doctoral students to understand the process of graduate study in this program. It is intended for both practitioners who have experience working with adult learners and people with little or no experience who have an interest in learning about the field. We will take a broad view of adult education and will accommodate the interest of persons concerned with nonformal education, informal learning, and formal learning in diverse settings. The principal aim is to develop a basic understanding of adult education in a global context as well as to begin preparing students for candidacy. The focus of the course will be on the sociohistorical context of its methods, agencies, programs, and issues.

ADTED 531: Course Design and Development in Distance Education

3 Credits

In depth study of the practices of designing courses taught by print, broadcast, and telecommunications media to adult distance learners.

Prerequisite: ADTED470 , INSYS415

ADTED 532: Research and Evaluation in Distance Education

3 Credits

Study of previous, current, and needed research strategies, and issues concerning evaluation in distance education.

ADTED 533: Global Online and Distance Education

3 Credits

Students will explore the historical and current developments of online and distance education in different regions of the world.

ADTED 542: Perspectives on Adult Learning Theory

3 Credits

Introduction to adult education learning theory, principles, and models of adult learning by adults alone, in groups, and in communities.

ADTED 543: Comparative and International Trends in Adult Literacy Education

3 Credits

This course critically examines the broad contemporary issues and interdisciplinary trends of literacy education with an international and comparative framework. CI ED (ADTED/AFR) 543 Comparative and International Trends in Adult Literacy Education (3) This course provides a comparative synthesis of what is known about literacy education and adult learning and what it will mean for the 21st century: the context in which literacy takes place; who participates; what they learn and why; the nature of the learning processes; new approaches to adult learning; social media and mobile devices; development theory in adult learning; and other issues relevant to understanding literacy education and adult learning in sociocultural, political, and international contexts. It also examines the newer approaches to adult learning: embodied, spiritual and narrative learning; learning and knowing in non-western perspectives; and cultural theory, poststructural and feminist perspectives. This course investigates questions such as: What does it mean to be literate in the 21st century? Why are teachers experiencing difficulty teaching students skills needed to understand and produce written work? Can schools in the 21st century inundated with digital technologies help students navigate the new literacies? How should adult literacy participants deal with the reality of new media and new literacies? What is the role of non-governmental organizations in this crisis? Overall, this course challenges graduate students to engage other international and non-western frameworks of learning and knowing to think about the purpose of education and learning as well as question the nature of knowledge production itself.

Cross-listed with: AFR 543, CIED 543

ADTED 545: Global Perspectives on Race, Gender, and Lifelong Learning

3 Credits

This course introduces students to some of the major bodies of literature related to race and gender, with a focus on how these intersectional perspectives help to shape our understanding of adult education and lifelong learning. The first part of the course is an overview of several key concepts including global theories of race and gender relevant to diverse societies in distinct geographical locations. The second part of the course explores the intersection of race, gender, and education through the writings of critical feminist scholars. Through this course, students will learn how to analyze race, gender, and class not as independent categories but deeply interconnected spheres of subjective and objective experiences. Students will also learn how theories of race and gender can inform their analyses of adult education policy and practice.

Cross-listed with: CIED 545

ADTED 549: Community Junior College and the Technical Institute

2-3 Credits/Maximum of 3

Distinctive contributions to meeting the need for postsecondary education; development, functions, curriculum and instruction, government, administration, and finance.

Cross-listed with: HIED 549

ADTED 550: Qualitative Research in Adult Education

3 Credits

Introduction to the theory, principles, and practice of qualitative research.

ADTED 551: Qualitative Data Analysis

3 Credits

Students learn to analyze data qualitatively by engaging in, and continuously reflecting on the process. ADTED 551 ADTED 551 Qualitative Data Analysis (3) The course is designed for graduate students wishing to gain competencies in qualitative data analysis. It is especially suitable for students needing guidance in completing the data analysis phase of their masters' or doctoral research. The course takes a thoroughly hands-on, inductive approach. Students learn the skills and principles of qualitative data analysis by engaging in, and reflecting on, the process. Texts will be consulted, as needed, but only as resources to assist in the students' on-going work, not as blue prints to follow. Using their own data, the instructor will guide students in selecting and using appropriate strategies and techniques for qualitatively analyzing data. Students will work in teams. Each work team will make periodic progress reports - in the form of oral class presentations. It is expected that students will actively participate in class discussions and in their work teams. Each student will also submit a diskette that contains samples of the work he or she has generated while using qualitative data analysis computer programs. Each student will also submit a final paper that articulates what he or she learned about the qualitative data analysis process.

Prerequisite: ADTED550 and LDT 574

ADTED 552: Participatory Action Research

3 Credits

Examines origins, historical development, main characteristics, methodological assumptions and models, practice of participatory action research adult education and community development. ADTED 552 ADTED 552 Participatory Action Research (3) This course is designed to provide students with a critical overview of the theory and practice of participatory action research (PAR). The course begins with an examination of the meaning and nature of participatory action research. Related issues such as the major differences between PAR and the orthodox, traditional research paradigm will be discussed. This will be followed with a discussion of the historical roots of PAR and a critical examination of its epistemological assumptions and philosophical roots. The course will explore the various models of doing PAR with particular reference to the guidelines, phases, methods, and techniques. Finally, the course will critically examine a selected number of case studies from various regions. Students will be evaluated using a variety of assignments. The scholarly paper, a case study of PAR practice, annotated bibliography and three reaction papers will count for 90% of the course grade. Class participation will be awarded 10%.

ADTED 560: Teaching Reading to College Students and Adults

3 Credits

Reading literacy for adults, including college reading, Adult Basic Education (ABE), and General Educational Development (GED) programs.

Prerequisite: LL ED440 or teaching experience

ADTED 561: Family Literacy

3 Credits

Examines the research related to the four components of family literacy, program effectiveness, and theoretical underpinnings. ADTED 561 ADTED 561 Family Literacy (3) Open to graduate students who are interested in literacy, adult education, early childhood education, family studies, communication, and related fields, this 3-credit course provides a research-based study of family literacy. Family literacy comprises four components: Adult literacy instruction, early childhood education, parenting education, and parent - child interaction. Research about the four components and the program as implemented in the USA (primarily under the Goodling Even Start Act) and internationally will be studied in addition to the theoretical underpinnings of the concept of family literacy. Students will be required to conduct original or library research related to family literacy and present their findings both in class and in a written paper that could be publishable. Students may choose to do research related to the projects of the Goodling Institute for Research in Family Literacy in the College of Education; students' papers may have the opportunity to be disseminated through the Institute. The research project, presentation, and paper will be counted as 50% of the course grade. Class participation (including email discussion groups) will be awarded 20% of the course grade while the remaining 30% will be awarded to short reaction papers to the assigned readings.

ADTED 562: Politics, Language and Pedagogy: Applying Paulo Freire today

3 Credits

Examines the work of Paulo Freire as it applies to community action projects. ADTED 562 / CIED 562 Politics, Languages and Pedagogy: Applying Paulo Freire Today (3) The life and work of Paulo Freire will be the focus of this advanced graduate seminar. Freire was one of the foremost adult educators of our time. Graduate students participating in the course will read and reflect on his vision and how it evolved over time, critiques of Freire, the ways in which his ideas have been applied in diverse geographic and practice settings (e.g., education, community development), and implications for research, policy, and practice. Students will explore how elements related to Freire's work, such as conscientization, transformative action, and pedagogy for liberation, influence pedagogy and community action projects. Readings will include Freire's books, scholarship on Freire, and case studies of Freirean projects, among others.

Cross-listed with: CIED 562

ADTED 564: Social and Cultural Contexts of Learning and Work

3 Credits

Examines the relationship between learning and work with special attention given to how certain forms of learning are legitimized. ADTED 564 Social and Cultural Contexts of Learning and Work (3) This course is designed to provide students with the knowledge and skills required to critically examine the concepts and meanings of learning and work and their relationship to community. The course focuses on formal, nonformal, informal, and incidental learning, with particular emphasis given to how different types of knowledge and different forms of learning are legitimized. The course will allow students to develop and understand the social context in which learning and work operate and how those concepts shape and impact the community. Students will write critiques

of readings as well as a major literature review, participate in class discussion, and do a class presentation.

Prerequisite: CI ED500 , ADTED542

Cross-listed with: CIED 564

ADTED 570: Comparative and International Adult Education

3 Credits

Critical and comparative analysis of adult education theory and practice outside North America, including international agency involvement.

Prerequisite: ADTED460

Cross-listed with: CIED 570

ADTED 575: Administration of Adult Education

3 Credits

Organization of a program of adult education; legal status, finances, selection of teachers, learning personnel, housing; other administrative problems.

Prerequisite: ADTED506 or EDLDR480

ADTED 580: Adult Education Research Seminar

1-3 Credits/Maximum of 3

A seminar dealing with specific research topics and methods in adult education. Open to advanced students in adult education.

Prerequisite: ADTED507 , EDPSY400 , EDPSY475

ADTED 581: Social Theory and Lifelong Learning

3 Credits

This course offers an in-depth coverage of social theory, especially as it intersects with research and practice in adult education and lifelong learning. Considering that educational research, educational practice, and the politics of justice in education are informed by specific theoretical frameworks, this course will explore historical and epistemological foundations of theories and engage core modernist theories, postmodern and critical theories, and the theorizing found in Global South discourses.

Cross-listed with: CIED 581

ADTED 588: Professional Seminar: Research and Adult Education

3 Credits

Review of research in adult education, current and past, with analysis of its directions, effects, methodology, quality, financing, and prospects.

Prerequisite: ADTED460 , ADTED507

ADTED 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

ADTED 594: Research Topics

1-18 Credits/Maximum of 18

Supervised student activities on research projects identified on an individual or small-group basis.

ADTED 595: Internship in Adult Education

3-9 Credits/Maximum of 9

Supervised student internship in adult education agency.

Prerequisite: ADTED460

ADTED 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects including non-thesis research, supervised on an individual basis and which fall outside the scope of formal courses.

ADTED 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

ADTED 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

ADTED 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

Ph.D. Dissertation research.

Prerequisite: passing score on the Ph.D. comprehensive examination

ADTED 602: College Teaching

1-3 Credits

Experience in teaching in the Adult Education Program.

Prerequisite: Advanced standing in the Adult Education graduate program.

ADTED 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

Aerospace Engineering (AERSP)

AERSP 504: Aerodynamics of V/STOL Aircraft

3 Credits

Jet wings, high lift devices, propellers and ducted propellers, circulation and boundary layer control, unsteady airfoil theory.

Prerequisite: AERSP407

AERSP 505: Aero- and Hydroelasticity

3 Credits

Interaction of elastic systems having several degrees of freedom with fluid flows in various configurations.

AERSP 506: Rotorcraft Dynamics

3 Credits

Modeling and analysis techniques for dynamic response, vibration, aeroelastic stability, and aeromechanical stability of rotary-wing vehicles.

Prerequisite: AERSP504 , E MCH571

AERSP 507: Theory and Design of Turbomachinery

3 Credits

Theory and principles of machinery design: compressors, turbines, pumps, and rotating propulsors; opportunity to work out design examples.

AERSP 508: Foundations of Fluid Mechanics

3 Credits

Mathematical review, fluid properties, kinematics, conservation laws, constitutive relations, similarity principles, the boundary layer, inviscid flow, vorticity dynamics, wave motion.

AERSP 509: Dynamics of Ideal Fluids

3 Credits

Irrotational flow theory, two-dimensional and axisymmetric flows, airfoil theory, complex variables, unsteady phenomena; flow with vorticity, finite wing theory.

Prerequisite: AERSP508

AERSP 511: Aerodynamically Induced Noise

3 Credits

Review of fluid mechanics. General theory of aerodynamic sound. Noise radiation from jets, boundary layers, rotors and fans. Structural response.

AERSP 514: Stability of Laminar Flows

3 Credits

The stability of laminar motions in various geometries as influenced by boundary conditions and body forces of various kinds.

AERSP 518: Dynamics and Control of Aerospace Vehicles

3 Credits

Dynamical problems of aircraft and missiles, including launch, trajectory, optimization, orbiting, reentry, stability and control, and automatic control.

Prerequisite: AERSP413 or AERSP450

AERSP 524: Turbulence and Applications to CFD: DNS and LES

3 Credits

First of two courses: Scalings, decompositions, turbulence equations; scale representations, Direct and Large-Eddy Simulation modeling; pseudo-spectral methods; 3 computer projects.

Prerequisite: AERSP508 or M E 521

Cross-listed with: ME 524

AERSP 525: Turbulence and Applications to CFD: RANS

3 Credits

Second in two courses: Scalings, decomposition, turbulence equations; Reynolds Averaged Navier Stokes (RANS) modeling; phenomenological models; 3 computer projects.

Prerequisite: AERSP508 or M E 521

Cross-listed with: ME 525

AERSP 530: Aerothermochemistry of Advanced Propulsion Systems

3 Credits

Physics and chemistry needed to analyze high performance rocket propulsion systems including reacting high temperature radiating gas and plasma flows.

Prerequisite: AERSP312 or M E 420

AERSP 535: Physics of Gases

3 Credits

An introduction to kinetic theory, statistical mechanics, quantum mechanics, atomic and molecular structure, chemical thermodynamics, and chemical kinetics of gases.

Cross-listed with: ME 535

AERSP 540: Theory of Plasma Waves

3 Credits

Solutions of the Boltzmann equation; waves in bounded and unbounded plasmas; radiation and scattering from plasmas.

Prerequisite: E E 471

Cross-listed with: NUCE 540

AERSP 550: Astrodynamics

3 Credits

Applications of classical celestial mechanics to space flight planning. Determination and construction of orbital parameters by approximation methods. Perturbation techniques. AERSP 550 Astrodynamics (3) This course covers the mathematics and practices in orbital mechanics as applied to space mission analysis, design and operation. The major topics are: the n-body problem, the two-body problem, Keplerian orbits, the Kepler problem (position as a function of time), three-dimensional specifications of Keplerian orbits (orbital elements), Lambert's problem (determining the trajectory between two specified points with a given time of flight), impulsive transfers, the Hohmann transfer and its extension to other problems, the sphere of influence, the patched-conic approximation, the restricted three-body problem, linear orbit theory

(relative motion between vehicles in neighboring orbits), gravitational modeling, perturbation methods (Encke's method and variation of elements), orbit determination, tracking kinematics, and time systems.

Prerequisite: AERSP450 or E MCH409 or PHYS 419

AERSP 552: Interplanetary Astrodynamics

3 Credits

This course focuses on mathematics and practices in interplanetary astrodynamics. Major topics include: astrodynamics applied to interplanetary space missions, the N-body problem, orbit transfers, Lambert's problem, gravity assists, planetary entry, descent and landing, planetary ephemerides, tracking sources and measurements, and spacecraft navigation. Other topics may be covered as time permits.

Recommended Preparations: AERSP 450 Sufficient proficiency in computer programming to code and debug a complex computer program. Fundamental knowledge in astrodynamics, as would be found in an junior or senior astrodynamics course.

AERSP 554: Statistical Orbit Determination

3 Credits

When tracking satellites in orbit, large amounts of tracking data (range, range-rate, azimuth, elevation) is collected. To convert this data to physical orbital elements of the satellite's orbit, this data must be filtered, and this filtering is done using methods of statistical orbit determination. This course focuses on the mathematics and practices in statistical orbit determination for analyzing large amounts of satellite tracking data. Major topics include: classical orbit determination techniques, probability and statistics, least-squares solution, weighted least squares, statistical interpretation of the least-squares problem, Cholesky decomposition, Gauss-Markoff theorem, sequential estimation algorithms, extended sequential estimation algorithms, square root filters, state noise compensation algorithm, state noise compensation algorithms, smoothing algorithms, minimum variance, maximum likelihood, Bayesian estimation. Other topics may be covered as time permits.

AERSP 560: Finite Element Method in Fluid Mechanics and Heat Transfer

3 Credits

Application of finite element techniques to viscous/unsteady fluid flow/heat transfer problems.

Prerequisite: AERSP312 , AERSP313

AERSP 565: System Identification

3 Credits

This course will cover topics related to identifying frequency response function as well as linear state space models from input-output data. Topics include continuous and discrete time models, frequency response functions, model structure & parameterization, non-parametric models, subspace methods, observability & identifiability, model order estimation, sparse approximation and relationship to maximum likelihood estimation & Kalman filtering.

AERSP 566: Applied Optimal Estimation

3 Credits

This course will cover topics from basic linear and nonlinear stochastic processes to well-known Kalman filtering methods to recently developed nonlinear estimation methods at a level of detail compatible with the design and implementation of modern control and estimation of dynamical systems. These diverse topics will be covered in an integrated fashion, using a framework derived from stochastic processes, estimation, control, and approximation theory.

Recommended Preparations: Consistent with coursework in undergraduate engineering programs, proficiency is required with linear algebra, calculus and control theory. In addition, proficiency with a scientific programming language (e.g., MatLab, Python) i

AERSP 571: Foundations of Structural Dynamics and Vibration

3 Credits

Modeling approaches and analysis methods of structural dynamics and vibration.

Prerequisite: AERSP304 , E MCH470 , M E 450 , or M E 570
Cross-listed with: EMCH 571, ME 571

AERSP 575: Aerospace Materials

3 Credits

Advanced materials are critical to improve performance, safety, and sustainability of air flight and space exploration in extreme environments. This course provides a survey of engineering knowledge on existing and future advanced materials for aerospace applications, and provides multiple opportunities for students to apply this knowledge and to analyze existing tailored aerospace materials of high performance. First, class participants will review the origins of the material properties: atomic bonding and packing, grains and boundaries, interfaces/interphases, and micro-structuring. Second, the participants will learn about common aerospace materials (metal alloys, ceramics, and polymer composites); how these materials satisfy the tight performance requirements and withstand extreme environments. Third, novel material design (nanocomposites and metamaterials), mostly in the nano and micro scales, and how their micro-structures drive their advanced properties will be discussed, together with their current challenges in applications (material design, scalable fabrication, and certification).

Prerequisites: AERSP 470 or ME 560 Recommended Preparations: Students should have knowledge on solid works (stress-strain constitutive relations, coordinate transfer, etc.), basic undergraduate-level math for engineering majors (ODE, matrix calculation, Cross-listed with: AMD 575

AERSP 583: Wind Turbine Aerodynamics

3 Credits

Analysis of wind turbine performance, aeroacoustics, and loads; turbine selection for site-specific application.

AERSP 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

AERSP 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

AERSP 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

AERSP 597A: **SPECIAL TOPICS**

3 Credits

AERSP 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

AERSP 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

AERSP 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Provides an opportunity for supervised and graded teaching experience in aerospace engineering courses.

AERSP 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

AERSP 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

AERSP 880: Wind Turbine Systems

3 Credits

Wind turbine technology and the critical elements of turbine systems design.

AERSP 886: Engineering of Wind Project Development

3 Credits

An overview of the wind project development process and technical considerations for onshore and offshore applications.

African American Studies (AFAM)

AFAM 501: Seminar in African American Studies

3 Credits

A survey of the academic field of African American Studies.

AFAM 502: Blacks and African Diaspora

3 Credits

Seminar in the theory and history of Blacks in the African Diaspora.

AFAM 503: Sexual and Gender Politics in the African Diaspora

3 Credits

A seminar in the theory and history of sexual and gender politics in the Black Diaspora from the Colonial Era forward.

Prerequisite: AF AM501

AFAM 520: Readings in African History

3 Credits

AFR 520 is a graduate seminar that gives students an overview of key literatures, methodologies, and debates in recent scholarship concerning various areas of precolonial, colonial, and postcolonial African history. Its broad temporal framing reflects the long, diverse histories of African peoples and their relations to Europe, the Americas, and Asia, while also allowing for examination of more recent and localized histories. Beginning in the era of transatlantic slavery and continuing to the present day, the selected texts constitute a sweeping examination of African history. In addition to covering a wide geographic scope—with works situated in North, East, South, and West Africa—the books engage with themes including slavery, health and healing, gender, religion, colonialism, nationalism, postcolonialism, and China's work on the continent. In addition to covering more recent additions to African historiography, course readings and assignments will encourage students to refine their research questions, interrogate the craft of history, strengthen their analytical writing, and expand the contours of their own fields. Graduate students will be prepared to: teach on the most recent studies of North and Sub-Saharan African history; more efficiently read and review academic texts; and carefully consider how they would frame, market, and detail their prospective dissertations as a potential book. This course is open to graduate student across departments.

Cross-listed with: AFR 520

AFAM 525: Trans of Color Critique

3 Credits

A history of transgender struggle has fomented intellectual formations that interrogate racial and gendered logics and proffer alternative structures of engagement, but commitment to any conceptualization of trans critique has often fallen back on assumptive ascriptions to non-racial analysis. Gathered at the concomitant study of race, gender,

sexuality, class, and socio-spatiality, *Trans of Color Critique* provides an opportunity to (re)consider the analytical and material possibilities and tensions tendered by the articulation of transgender and non-white. Engaging with trans (and queer) of color theory as a particular approach to the political and as its own mode of knowledge production, we will not only take up the mutual constitution of race and gender, but center how whiteness has come to construct the burgeoning field of trans studies. In this graduate seminar we will consider the ways in which these multiply marginalized knowledges aim a critical challenge at our Western knowledge traditions. The course considers how race as a modality of analysis and trans of color critique as a praxis can in turn amplify, extend, and complicate the framework and analytical interventions offered by trans studies. Rather than attempt to be exhaustive, we will focus on the urgent interventions offered by trans of color critical theory, especially as it relates to foundational disruptions of Western epistemologies, medicalization, humanism, movement and displacement, decolonial critique, carcerality, violence and death, and futurity.

Recommended Preparation: Prior coursework in Women's, Gender, and Sexuality Studies is recommended as well as familiarity with critical cultural and social theory.

Cross-listed with: WMNST 525

AFAM 544: Race and American Politics

3 Credits

In this seminar, we will explore what race is, why it matters, and how it shapes attitudes, behaviors, policies, and institutions. While this is a political science course, the seminar draws ideas and insights from a broad array of disciplines in the social sciences and humanities. It demonstrates that an explicit consideration of race is needed to fully comprehend American politics. Students emerge from the course with an understanding of the scholarly approaches and key substantive debates.

Cross-listed with: PLSC 544

AFAM 553: Comparative Racial and Ethnic Politics

3 Credits

Since its founding, the United States has had to balance the American creed of equality for all, on one hand, with racial inequality, on the other hand. Is this challenge something exclusive to the United States? This course will provide students the opportunity to analyze how race and ethnicity are constructed across the globe as well as how race and politics interact across state borders. Students will examine how race is constructed and racial ideologies are developed in several countries including the U.S., South Africa, France, Australia and Brazil. By the end of the semester, students should be able to fully engage and contribute to broad literatures on the politics and policy of race and racism. They should readily be able to answer questions such as: What role do countries and their institutions play in developing racial ideologies and racial hierarchies? What political purpose do ideologies such as "racial democracy" serve? How might social scientists best compare notions such as U.S.'s "race problem," Latin America's "shade problem" and Europe's "immigrant problem"? What are the perils of cross-border comparisons, and how, if possible, can social scientists account for state differences in their analyses? The major objectives of the course are to: (1) analyze the effects of historical, social, economic, cultural and global forces on the development of racial and ethnic politics in various countries; (2) define and critically analyze concepts relevant to the study of racial and ethnic politics; (3) identify, critique and apply major academic theories and debates regarding issues of

race, ethnicity, inequality and reconciliation; (4) build analytical skills so that students will be able to effectively engage and communicate in public and scholarly discourse about race and ethnic politics; (5) improve writing skills, especially as they relate to manuscript and book reviews; (6) become cognizant of the difficulties that scholars must navigate as they approach topics related to the politics, race, ethnicity as well as comparative/cross-state analysis; and (7) develop a series of best practices to address methodological and theoretical challenges to studying race comparatively.

Cross-listed with: PLSC 553, PPOL 553

AFAM 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

AFAM 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

African Studies (AFR)

AFR 501: Key Issues in African Studies

3 Credits

A seminar to review leading issues in African Studies and African development.

AFR 505: African Studies Methodology

3 Credits

This course is an interdisciplinary research seminar in African Studies for graduate students in the humanities. In the seminar, students will explore key debates and issues in the field while examining the diversity of theoretical and methodological approaches that scholars of African Studies have used to approach these debates. Through research articles that each employ a different set of methodological tools to examine questions of modernity and tradition, development, gender, ethnicity, conflict, and transnationalism, students will understand the possible approaches that can be employed to identify a research questions, gather evidence, and analyze it. Through reading and discussing such research articles, and discussing with scholars who visit class to present their research, students will gain conceptual tools to advance a research project in methodologically-grounded ways. While some topics will apply more directly to the student's individual research project, the themes studied are those that all scholars of African Studies should have some knowledge and mastery over, and each module will give students an opportunity to experiment by applying the theory and methods referenced in the scholarly literature to primary sources relevant to the student's own research. See syllabus in supplementary materials for more information.

AFR 510: Post-Colonial Theory

3 Credits

The term post-colonial within itself has manifold meanings and implications. It is also considered a controversial term as many wonder exactly what is post to colonialism. In this class, we will explore colonial

discourse theory, the roots of European imperialism and racism, and feminist constructions in relation to post-colonial theory. We will engage with and read critical theory, literature, and film to analyze the relations of power that (re)generate the roles of domination and dominated, and the in-between states of negotiation.

Cross-listed with: ENGL 510

AFR 512: Decolonial Methods for Interdisciplinary Research

3 Credits

This course surveys contemporary scholarship in multiple disciplines to provide an overview of decolonial research methods and analytical frameworks. Each week, the readings will engage a different topic related to historical and contemporary ways of thinking about land, personhood, and power. Intended for students who are interested in initiating their own research projects in the future, the course is structured to enable students with little prior knowledge of archives or research methods to plan, begin, document, and revise an original project. Combining the study of theoretical readings with weekly research and reflection, students will develop critical tools for thinking, speaking, and writing about colonialism at the University and in a subject area of their choice. Theories are enabling, dynamic, and helpful tools for approaching texts, objects, situations, places, narratives. In this course, they will encounter things both familiar and unfamiliar in ways that unsettle not only their expectations but also their presumed relationship to what they know, where they are, and what might happen next.

Recommended Preparations: Students should have taken at least one research methods course.

Cross-listed with: EDCE 512

AFR 520: Readings in African History

3 Credits

AFR 520 is a graduate seminar that gives students an overview of key literatures, methodologies, and debates in recent scholarship concerning various areas of precolonial, colonial, and postcolonial African history. Its broad temporal framing reflects the long, diverse histories of African peoples and their relations to Europe, the Americas, and Asia, while also allowing for examination of more recent and localized histories. Beginning in the era of transatlantic slavery and continuing to the present day, the selected texts constitute a sweeping examination of African history. In addition to covering a wide geographic scope—with works situated in North, East, South, and West Africa—the books engage with themes including slavery, health and healing, gender, religion, colonialism, nationalism, postcolonialism, and China's work on the continent. In addition to covering more recent additions to African historiography, course readings and assignments will encourage students to refine their research questions, interrogate the craft of history, strengthen their analytical writing, and expand the contours of their own fields. Graduate students will be prepared to: teach on the most recent studies of North and Sub-Saharan African history; more efficiently read and review academic texts; and carefully consider how they would frame, market, and detail their prospective dissertations as a potential book. This course is open to graduate student across departments.

Cross-listed with: AFAM 520

AFR 526: African Social and Cultural Systems

3 Credits

The African continent may be the most diverse of all the continents in its composition of ethnic groups, social and kinship arrangements, belief systems, and political processes. Its cultures have been subjected to further transformation by different colonial governance structures, decolonial apparatuses, differing ideals of modernity, and differing interactions with religions like Christianity and Islam. However, with all the differences and transformations, what are the elements that tell us about societies across the continent? This course details various social and cultural systems, from a regional perspective, to provide background knowledge to help students develop their understanding of the many different societies on the continent. The regional focus is further divided by into topics such as kinship relations, governance, and religion. As each region and topic area is covered, students will begin to understand areas of intersection, fissures brought by modernity, bridges and divides across ethnicities and regions: Kinship This subsection of the course on kinship provides an analysis of how kinship theories of social formation can facilitate our understanding of the different dimensions of African social practices in historical and contemporary Africa. It propels students' understanding of multiple theories of kinship, with a focus on the relationships between kinship and life-span relations, pension sharing, circular migration, gender, politics, and patronage. Governance Most African countries, irrespective of their degree of economic sophistication, are characterized economically by dual forms of governance—one that derives its authority from the state and the other that may be construed as traditional. The traditional governance section of the course addresses three overarching questions: (1) Why have traditional institutions of governance remained relatively robust in post-independent Africa even when faced with relatively hostile governments? (2) What are the levels of adherence and allegiance of rural Africans to traditional institutions? and (3) How are disputes resolved within traditional institutions? Religion There are three dominant forms of religions in Africa: Christianity, Islam, and Traditional African religions. These practices of these religions were affected by the experiences of colonialism and postcolonialism as well as Africa's subsequent integration into the global economy. All of these religions are related to various forms of social organization, authority, and power and may vary between regions and ethnic groups.

AFR 527: Migration, Urbanization, and Policy in the Developing World

3 Credits

This course examines the dynamics of migration and urbanization processes, as well as their policy implications, in non-industrialized regions of the world.

Cross-listed with: SOC 527

AFR 530: Perspectives on African Language Research in the Global South

3 Credits

The innovations and challenges of the Global South extend beyond an agenda that redresses exclusions. Rather, these are deep-seated challenges to the core tenets of language research as well as new directions for theories and practices on language research in the Global South in general. A renewal of southern epistemologies requires an understanding of the absences such knowledge implies. To engage with the transformative potential of non-Eurocentric thinking, the course explores the relevance of a decolonial imagination that makes it possible to envisage an alternative reality and justice that engenders "radical

hope." Topics central to the course are the decolonization of research methods, feminist perspectives on African languages, Southern Multilingualisms and education, digitization of African cultural practices, indigeneity, an engagement with "Indigenous cosmovisions," and reinvented traditional concepts, such as ubuntu or sumac kawsay, that suggest that the formation of other worlds is feasible. These newly reinvented cosmovisions render it feasible to move beyond the limitations of Western-centric politics and knowledge production. The course is far more than a critique of the Global North's scholarship. It will cultivate a decolonial imagination, consequently producing African language knowledge with the South, and not on the South.

Cross-listed with: APLNG 530

AFR 532: Environment and Livelihoods in Africa

3 Credits

An enquiry into the relationships between the environment, resource control, resource conservation, rural livelihood systems and poverty in Africa. AFR 532 Environment and Livelihoods in Africa (3) The seminar examines the relationships among the environment, resource control, conservation and rural livelihoods in sub-Saharan Africa. Readings will allow students to develop a critical understanding of the ideology and epistemology of environmental management, resource control, rural development and poverty in sub-Saharan Africa. Students will be encouraged to interrogate modernist doctrines such as population-environment narratives, poverty-stewardship narratives and related environmental ideologies/narratives that embody sustainability and rural (under)development in sub-Saharan Africa. Through case study examples, students will use these conceptual foundations to trace the relationships between sustainability and poverty in a number of livelihood systems and resource control regimes. Some examples are resource (land/water) management between the state and nomadic pastoral systems; land reform and rural peasant livelihood systems; mining and rural livelihood systems; and national parks, trans-frontier parks and rural livelihood systems.

AFR 534: Political Economy of Energy and Extractive Industries in Africa (Oil and Mining)

3 Credits

Given the rising global demand for energy and resources, Africa's production of oil and solid minerals has already produced very significant positive as well as negative impacts on the continent's political, economic, and social conditions. This seminar examines the extractive industry-driven changes in Africa's political economy, as well as in the continent's foreign relations. Students will examine the institutional basis under which the expansion of the industry is taking place in Africa. This will involve discussions of the institutional characteristics of Africa, including issues of land tenure and property rights laws, how institutional systems are changing in order to facilitate the industry's expansion, and the repercussions of these changes upon society. The course also interrogates the relevance of international efforts to mitigate some of the adverse impacts of the industry. Among such efforts is the UN Guiding Principles for Business and Human Rights. Overall this seminar examines the industry's impact on Africa's socioeconomic development and global relations, and concludes with how African countries might deal with the adverse impact of the Oil and Mining industry.

Cross-listed with: INTAF 534, PLSC 534

AFR 537: Gender, Sexuality and Islam in Africa: Exploring Contemporary Feminist Scholarship

3 Credits

A course about discourses of sexuality and gender in studies of Islam in Africa, with South Africa as a case study.

Cross-listed with: WMNST 537

AFR 543: Comparative and International Trends in Adult Literacy Education

3 Credits

This course critically examines the broad contemporary issues and interdisciplinary trends of literacy education with an international and comparative framework. CI ED (ADTED/AFR) 543 Comparative and International Trends in Adult Literacy Education (3) This course provides a comparative synthesis of what is known about literacy education and adult learning and what it will mean for the 21st century: the context in which literacy takes place; who participates; what they learn and why; the nature of the learning processes; new approaches to adult learning; social media and mobile devices; development theory in adult learning; and other issues relevant to understanding literacy education and adult learning in sociocultural, political, and international contexts. It also examines the newer approaches to adult learning: embodied, spiritual and narrative learning; learning and knowing in non-western perspectives; and cultural theory, poststructural and feminist perspectives. This course investigates questions such as: What does it mean to be literate in the 21st century? Why are teachers experiencing difficulty teaching students skills needed to understand and produce written work? Can schools in the 21st century inundated with digital technologies help students navigate the new literacies? How should adult literacy participants deal with the reality of new media and new literacies? What is the role of non-governmental organizations in this crisis? Overall, this course challenges graduate students to engage other international and non-western frameworks of learning and knowing to think about the purpose of education and learning as well as question the nature of knowledge production itself.

Cross-listed with: ADTED 543, CIED 543

AFR 550: African Feminisms

3 Credits

African feminisms are deeply rooted in the continent's rich historical traditions and diverse cultural contexts. In this interdisciplinary graduate seminar, students will become familiar with the theoretical frameworks that guide African feminist scholarship, as well as the activist histories from which they emerged. This course will consider the epistemological foundations of African feminist thought and how they differ from feminisms in other parts of the world. This course will also examine key areas of conjuncture - how African feminisms map on to larger transnational movements. Particular emphasis will be placed on the fluidity of African gender systems, the ways in which African women have negotiated politics, religion, militarism, sexuality, and violence, and the role of creativity, art, and beauty in nurturing and sustaining activist momentum. Students in the course can expect to engage with a number of different types of texts: documentaries, feature films, memoirs, novels, newspapers, scholarly books, and articles.

Cross-listed with: WMNST 550

AFR 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

AFR 597: Special Topics

1-9 Credits

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

Agricultural and Biological Engineering (ABE)

ABE 500: Research Methods

3 Credits

Foundation in research philosophies, methodologies, issues and policies; measures of research quality; critical thinking and discourse; research report writing; professional development; research ethics. A B E (BRS) 500 Research Methods (3) A B E/BRS 500 is a course designed to assist students entering and advancing in their research career to: better investigate and practice the art of scientific investigation; openly explore and discuss what it means to be a part of the scientific and research enterprise at a major academic setting; gain skills and experiences in critical evaluation and discourse; learn the process of developing and preparing a research proposal from initial concept to near-final written product; better understand the expectations for responsible and ethical conduct as a scientist/student/individual; and further develop their philosophies and capabilities as future scientists and professionals. During this course students will continually read, think, discuss, write, critique, re-read, re-think, re-write, and communicate with other students, faculty, and professionals. The course will provide a setting to allow them to further develop their personal, professional, academic, and scientific goals and capabilities.

Cross-listed with: BRS 500

ABE 504: Mechanics and Properties of Particulate Materials

3 Credits

Constitutive equations for cohesionless and cohesive particulate materials; measurement of properties; application to storage, flow, and consolidation.

ABE 513: Applied Finite Element, Finite Difference, and Boundary Element Methods

3 Credits

Applications of numerical methods in the areas of structures, fluid dynamics, heat and mass transfer, and machine design.

ABE 517: Surface Transport of Agricultural Pollutants

3 Credits

Understanding and modeling the surface transport processes of agricultural pollutants; particularly erosion, sediment transport, and movement of sediment-attached constituents.

ABE 559: Biological and Agricultural Systems Simulation

3 Credits

Continuous simulation modeling of biological and physical systems, numerical simulation techniques, validation and verification, difference measures, sensitivity analysis. A B E 559 A B E 559 Biological and Agricultural Systems Simulation (3) This course enables the student to better understand system behavior and prediction, with a focus on biological and physical systems. Using a diagramming-based model development package and standard spreadsheet programs, the student will be able to: identify a system, labeling components, boundaries, and environment; represent a system in mathematical terms; develop a working simulation model; evaluate a model through statistical means. The applications used within this course are oriented towards graduate students in the Colleges of Agricultural Sciences and Engineering. The course is offered every Fall semester, with an expected enrollment of 10 students. Grading is based on homework and in-class assignments, and a final project.

Prerequisite: MATH 111 or MATH 141

ABE 568: Food Safety Engineering

3 Credits

Predictive microbiology and modeling, conventional and novel detection and enumeration methods, conventional and novel processing methods, applied to plant layout, construction materials, and equipment design for microbial food safety. A B E 568 A B E 568 Food Safety Engineering (3) This course introduces diverse topics in microbial food safety from an engineering perspective. Topics include the following: the roles of engineering, plant layout, construction materials, equipment design, predictive microbiology and modeling, conventional and novel detection and enumeration methods, conventional and novel processing methods, emergency contingency plans, and current responsibilities and regulations of federal agencies for food safety. Students will be evaluated through homework, exams, design project reports and presentations. The course will be offered every other Fall semester with expected enrollment of 10-15.

Prerequisite: A B E308

ABE 587: Computational Ecohydrology

3 Credits

Ecohydrology is an integrative science that studies mutual interactions between hydrological, biogeochemical, and ecological processes. The lectures of the course will discuss the fundamental processes controlling the flow of water in the biosphere (in land, atmosphere, soil, and plants) and the interactions with ecological processes, implications of ecohydrological feedbacks covering broad range of issues including global environmental change, land use change, global desertification/land degradation, urbanization, soil erosion, and the food-energy-water nexus. The computational lab will provide hands-on experience on ecohydrological analysis with geographic information system software

and ecohydrologic model. The course will also introduce students to parallel computing and optimization methods.

Recommended Preparation: Previous coursework in hydrology is expected

Cross-listed with: CE 587

ABE 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

ABE 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

ABE 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

ABE 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

ABE 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

ABE 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Supervised experience in development of instructional materials, organizing and conducting lectures, laboratories, and evaluating students in undergraduate Agricultural Engineering courses (1-499).

ABE 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

ABE 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

ABE 884: Biomass Energy Systems

3 Credits

Theories and applied technologies for production and conversion of biomass into energy and co-products.

ABE 885: Biomass Harvesting and Logistics

3 Credits

Biomass harvesting and handling scenarios and relevant cost analysis and systematic considerations.

Prerequisite: A B E884

ABE 888: Conversion Technologies for Bioenergy Production

3 Credits

Applications of chemical, biochemical, thermochemical, and bioseparation technologies for the production of bioenergy.

Prerequisite: A B E884

Agricultural and Environmental Plant Science (AEPS)

AEPS 502: Current Issues in Agricultural Innovation

2 Credits

Current Issues in Agricultural Innovation was designed to expose students to a broad overview of modern agricultural research topics and to consider how Scientific, Ethical, Legal and Social Issues impact their adoption. In this class, we will explore how modern agricultural technologies, particularly those related to cropping systems and plant-based foods, can provide substantial economic and nutritional benefits, while simultaneously reducing risks to the environment and human health generated by agricultural practices. We will also explore the risks of agricultural innovations and potential problems associated with them. Agriculture research and science innovation often intersect with ethical considerations and this theme will be one of the main topics and also dispersed throughout each of the class meetings. We will examine the social dimensions of scientific research and technology development. This includes reading and discussing work on how social contexts influence scientific research and technology diffusion, on variations among the public and expert on perceptions of research and technology risks, on differences between public and private research institutions, and on validity and integrity in regulatory systems.

AEPS 510: Ecology of Agricultural Systems

3 Credits

This course overviews current research on agroecological processes and management for long-term agricultural sustainability and ecosystem services given current and emerging issues such as population growth and climate change. Emphasis is placed on learning via reading and discussing the recent agricultural and agroecological scientific literature. Students gain experience critically analyzing scientific papers and theories and develop scientific communication and teaching skills through presentations and facilitation of class discussion. Students also briefly present their graduate research and facilitate discussion of one article that they select for the class to read.

Prerequisite: BIOL 546 or HORT 445 or the equivalent (Classic Ecology, Population Ecology or Plant Ecology)

AEPS 515: Professional Development for the Plant Sciences

3 Credits

Graduate students in the Plant Sciences receive excellent exposure and training in their field of expertise. However, in today's competitive and diverse job market, successful students will also benefit from exposure to professional development, career exploration, and leadership training. In addition to providing discussion-based content related to professional development, this product-oriented course will introduce students to tools and skills and provide space for practice and reflection. After completing this course, students will be able to: 1) Get the most benefit from their graduate program, 2) Identify possible future careers, and 3) Position themselves to be prepared and competitive for their chosen profession. Thus, this course will aid students as they both adjust to new expectations in Graduate School and actively navigate a path towards the career of their choice.

AEPS 555: Effective Scientific Communications

3 Credits

Students will learn to effectively present their research to scientific and non-scientific audiences. The overall goal of the course is to develop student skills in spoken and written communication of scientific concepts, methods, and data, and to provide effective evidence-based recommendations for practical application of such knowledge. In addition, students will develop skills in writing testable hypotheses, evaluating experimental approaches, considering alternative approaches, and envisioning expected outcomes of a research plan.

Cross-listed with: PPATH 555

AEPS 573: Interpreting Data from Experiments with Quantitative Treatments

3 Credits

Interpreting Data from Experiments with Quantitative Treatments (AEPS 573) is an applied regression course that employs statistical analysis in the context of agricultural/horticultural experimentation. Analytical approaches include: descriptive statistics, data distribution(s), data graphing/representation, correlation, least squares linear regression, general linear models, mixed linear models, generalized linear mixed models, non-linear regression models, and discrete response regression models. Graphical techniques are demonstrated to identify unusual observations and recognize relationships. Discussions will focus on identifying the best models with linear, polynomial, and multiple linear regression techniques for data obtained from both observational and designed experiments. Fixed and/or mixed model approaches will be used for experiments with designs and treatment structures common to agricultural and horticultural experiments, such as blocked designs, and factorial and augmented factorial treatment structures. Analysis of covariance will be discussed in detail to include situations with homogeneous and nonhomogeneous slopes and factorial experiments involving repeated measures and/or additional indicator variables. Analysis of covariance will also be presented as an alternative to blocking. Practical applications of nonlinear and logistic regression methods will also be discussed.

Prerequisites: AEPS 808; ENT 535; STAT 500

AEPS 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

AEPS 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

AEPS 600: Thesis Research

1-15 Credits/Maximum of 15

No description

AEPS 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description

AEPS 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Supervised experience in teaching and orientation to other selected aspects of the profession at The Pennsylvania State University.

AEPS 610: Thesis Research Off-Campus

1-15 Credits/Maximum of 999

No description.

AEPS 808: Applied Computational Analysis

3 Credits/Maximum of 999

Comprehensive appraisal of designs for field, greenhouse, and growth-chamber experiments; and techniques for data collection, analysis, inference, and presentation. This course provides practical guidance in effective design, management, and interpretation of parametric experimentation by agricultural, environmental, and/or horticultural researchers. After successfully completing the course, students will be able to: define and specify appropriate experimental designs for field, greenhouse, and growth chamber research with consideration of the planned hypotheses, methodologies, and available resources; interpret/classify types of response data, describe components of experimental error and develop sampling/data collection strategies for control of error, bias, and confounding. Students will demonstrate proficiency in data organization and pre-processing for computational analysis; distinguish the required assumptions of analysis of variance (ANOVA), describe procedures to assess and resolve initially noncompliant data sets; implement software code for data analysis by experimental design; invoke appropriate mean separations, contrast statements, covariate structures, and linear estimators as necessary to optimize inference; employ software output to construct tables/figures that clearly depict sources/parameters/statistics; and construct line-, bar-, or scatter-plot graphs to describe mean response and/or significant trends/differences. The objective of Applied Computational Analysis is to expand the

student's ability to conduct research through proficient experimental design, methodology, data analysis, and results inference.

AEPS 851: Applied Plant Population Biology

3 Credits

The course is designed to give potential superintendents and managers of large land holdings (such as golf courses, highway roadsides, game lands, military installations) and areas surrounding agricultural operations), the skills necessary for making sound ecological decisions regarding the choice and management of plant materials utilized in agriculture, land restoration and revegetation.

Agricultural Biosecurity (AGBIO)

AGBIO 520: Agricultural Biosecurity: Protecting a Key Infrastructure

3 Credits

Course will explore intentional and unintentional threats to the agriculture- food system, history and current approaches for safeguarding this key infrastructure.

Prerequisite: permission of the instructor

AGBIO 521: Food Defense: Prevention Planning for Food Processors

3 Credits

Course prepares current and aspiring professionals to learn, recognize and apply measures to prevent intentional contamination of the food supply. FD SC (AGBIO) 521 Food Defense: Prevention Planning for Food Processors (3) This course will not only provide participants with knowledge of the domestic and international food industry, but it also provides tools for food industry and homeland security professionals to develop food defense programs to protect the food supply from terroristic activities leading to intentional contamination. The course will introduce and apply: examples where intentional contamination has been used in the food industry; biological, chemical and physical hazards of primary concern in the food industry; methods for detecting hazards in the food supply; systems employed to monitor foodborne illness in the general public; management practices employed in food production to deal with recalls and other crises; vulnerabilities and mitigation procedures unique to food production; as well as agencies, resources, and tools needed to protect, prepare, and respond to intentional contamination incidents. This course is a required course for the certificate program in Agricultural Biosecurity as well as the Master of Professional Studies in Homeland Security/Agricultural Biosecurity Option. These principles also will be incorporated into a food defense plan, recall plan, and emergency preparedness plan for an assigned food establishment.

Cross-listed with: FDSC 521

AGBIO 594: Agricultural Biosecurity and Food Defense Capstone Experience

3 Credits

Culminating experience in the iMPS-HLS for the online Agricultural Biosecurity and Food Defense option.

Prerequisite: AGBIO520 , AGBIO521 , AGBIO801 , and AGBIO802

AGBIO 801: Veterinary Infectious Disease Diagnostic and Surveillance Systems

3 Credits

This course provides knowledge of diagnostic and surveillance systems used to detect infectious diseases and protect against animal agricultural biological attack.

Prerequisite: AGBIO 520

Cross-listed with: PATH 801

AGBIO 802: Plant Protection: Responding to Introductions of Threatening Pests and Pathogens

3 Credits

This course provides knowledge of plant biosecurity, plant disease, regulations, and technologies using case study examples.

Cross-listed with: PPATH 802

Agricultural Economics and Rural Sociology (AEREC)

AEREC 503: Agricultural Marketing

3 Credits

Economic analysis of food marketing firms and institutions; identification and measurement of dimensions of market performance; public policy.

Prerequisite: ECON 502

AEREC 533: Rural Development Research Methods and Topics

3 Credits

Advanced theories and methods for rural economic development research.

Prerequisite: ECON 521

Cross-listed with: CEDEV 533

AEREC 595: Internship

1-18 Credits/Maximum of 18

Supervised off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

AEREC 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and fall outside the scope of formal courses.

AEREC 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given infrequently to explore, in depth, a comparatively narrow subject which may be topical or of specific interest.

AEREC 597A: **SPECIAL TOPICS**

3 Credits

AEREC 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

AEREC 601: Thesis Preparation

0 Credits/Maximum of 999

No description.

AEREC 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 3

No description.

AEREC 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

Agronomy (AGRO)

AGRO 501: Graduate Student Dialogue

1 Credits

Orientation discussion group for incoming graduate students. Review departmental policies and learn about the diverse faculty programs in the department. AGRO 501 Graduate Student Dialogue (1)The objectives of this course are to (i) provide orientation on departmental policies and procedures to incoming graduate students, (ii) introduce students to the wide array of faculty research programs in the department, and (iii) build camaraderie among the cohort of students. This course is required of new graduate students in the department, yet inapplicable to '500-level major field' credit requirement. The course is graded pass/fail with emphasis on weekly classroom participation.

AGRO 518: Responses of Crop Plants to Environmental Stress

3 Credits

Physiological and ecological aspects of the response of crop plants to environmental stresses in establishment, persistence, and reproduction.

Prerequisite: AGRO 410W

AGRO 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

AGRO 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

AGRO 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

AGRO 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

AGRO 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 3

Supervised training in teaching methodology for classroom and laboratory type instruction. Supervision provided by faculty member responsible for course.

AGRO 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

AGRO 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

American Studies (AMST)

AMST 500: Theory and Methods

3 Credits

Introduction to graduate work in American Studies through exploration of the approaches, materials, and interpretations of the field.

AMST 502: Problems in American Studies

3-6 Credits/Maximum of 6

A variable-content course, addressed each term to a specific problem, topic, or period in American culture.

AMST 510: U.S. Literature and Culture

3 Credits

Studies exploring the relationship between literature and culture in American Studies.

AMST 511: Pivotal Books

3-9 Credits

Exploration of a number of books which have been particularly influential in shaping thinking about American civilization.

AMST 520: Topics in Popular Culture

3 Credits

A detailed exploration of aspects of American popular culture, including popular culture's relationship to society and scholarship.

AMST 530: Topics in American Folklore

3 Credits/Maximum of 9

This is an advanced topics seminar in folklore studies. It will provide students with a command of the research literature in a specific area of folklore research, based on the topic defined by the instructor.

AMST 531: Material Culture and Folklife

3 Credits

Investigation of American material culture and folklife, including topics such as traditional design, cultural landscape, architecture, art, craft and food.

AMST 533: American Civilization in the Eighteenth Century

3-9 Credits

Detailed investigation of specific topics in eighteenth-century American civilization.

AMST 534: American Civilization in the Nineteenth Century

3-9 Credits

Representative interdisciplinary investigation of social, historical, economic, and aesthetic forces predominant in nineteenth-century America.

AMST 535: American Civilization in the Twentieth Century

3-9 Credits

Detailed investigation of specific periods or topics in twentieth-century American civilization.

AMST 536: American Civilization in the Twenty-first Century

3 Credits

Detailed investigation of specific topics in twenty-first century American civilization.

AMST 540: Ethnography and Society

3 Credits

An advanced course on ethnographic theories, methods, and case studies, emphasizing current controversies and new strategies in field work.

AMST 541: Ethnography of Technology and Media in the United States

3 Credits

Applied widely across the humanities and social sciences, ethnographic approaches to the study of culture encompass a wide variety of qualitative research methods that range from intimate personal interviews to participation in large group events. This seminar presents a detailed study of how the integration of technologies into the fabric of everyday life in the United State has both enabled the creation of new cultural forms and redefined existing social and cultural life. Students will engage with foundational and emerging works that apply the theories and methods of ethnography to the close study of technology and media use and culture, as well as works that demonstrate how emerging technologies may be applied in ethnographic research. In addition to

presenting the relevant literature, this seminar will provide students with rigorous training in the requisite skills and concepts that define ethnographic practice, and offer opportunities for students to apply these skills and concepts to produce significant field research. Examples of technological forms considered could include video games, 3D printing and maker technologies, genetic technologies, mobile phones and devices, and a variety of internet technologies.

AMST 550: Seminar in Public Heritage

3 Credits

A study of the ways Americans use and understand heritage in public settings.

Prerequisite: AMSTD482**AMST 551: Seminar in Local and Regional Studies**

3 Credits

Detailed investigation of local and regional historical themes and topics, emphasizing research methods.

AMST 560: Seminar in Race and Ethnicity

3 Credits

Studies exploring issues of race and ethnicity in America that can be addressed with theories and methods of American Studies.

AMST 561: Seminar in Gender and Culture

3 Credits

Thematic study of gender issues in American history and culture.

AMST 562: Topics in Religion and American Culture

3 Credits/Maximum of 6

Contrary to notions about the secularization of American society, a large number of Americans continue to report that religion plays an important role in their everyday lives. At the same time, changing demographic, political, and cultural environments in the United States have contributed to a massive reorganization of the American religious landscape since 1970. Thus religion, it seems, is a timely issue in the study of American culture, one which will doubtless open up new avenues of American Studies research in the future. This seminar is a detailed study of aspects of religious history and culture in the United States. It will offer students an overview of the current engagement of American Studies with the study of religion and ask students to consider new pathways in this research for the future.

AMST 570: Topics in American Art

1-6 Credits

Various themes within the American arts will be explored under this rubric.

AMST 575: Museum Internship

3 Credits

A supervised museum internship experience featuring a "hands on" introduction into aspects of the curatorial profession.

AMST 579: Readings in American Studies

3-9 Credits

Directed readings in selected areas of American Studies. AM ST 579 Readings in American Studies (3-9) This course will cover major readings in a selected area of American Studies. The readings are designed to represent past and current scholarship in an area of research undertaken by a student or students. The selection of readings will be directed by a faculty member in consultation with the student(s). The readings typically cover areas that are not covered in depth within other American Studies offerings. Outcomes of the course include historiographies and theoretical essays, annotated bibliographies, and book reviews.

Prerequisite: AM ST500

AMST 580: Projects in American Studies

1-6 Credits/Maximum of 6

Independent exploration within American Studies; evidenced by major paper, film, exhibition or specialized examination.

AMST 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

AMST 591: Seminar in American Studies

3 Credits

An advanced seminar covering particular themes and issues in American Studies.

Prerequisite: AM ST500

AMST 595: Internship

1-12 Credits/Maximum of 12

Supervised off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

AMST 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

AMST 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

AMST 600: Thesis in American Studies

1-15 Credits/Maximum of 999

A thesis supervised by the American Studies Program.

Prerequisite: AMSTD500

AMST 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

AMST 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Supervised experience in teaching and orientation to other selected aspects of the profession at The Pennsylvania State University.

Prerequisite: AM ST500 and permission of the doctoral program director

AMST 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

AMST 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

Anatomy - MD (ANAT)

ANAT 503: Gross Anatomy

6 Credits

Gross structure, organization, and function of the human body with laboratories devoted to dissection of the human body.

ANAT 505: Histology and Embryology I

2 Credits

Light and electron microscopic structure of cells, specialized tissues, organization, basic organogenesis, correlation between cellular structure and physiological function.

ANAT 506: Histology and Embryology II

2 Credits

Continuation of ANAT 505; microscopic structure of cells, specialized tissues, organization, basic organogenesis, correlation between cellular structure and physiological function.

Prerequisite: ANAT 505

ANAT 512: Human Embryology and Teratology

2 Credits

Study of developing human embryo including gamete production and fusion, implantation, organogenesis and major abnormalities of organ systems.

ANAT 515: Developmental Neurobiology

2 Credits

Development of the nervous system in all its aspects.

Cross-listed with: NEURO 515

ANAT 585: Human Anatomy and Development B: Human Development

1 Credits

Explores human embryology and organogenesis beginning at the third week of gestation through parturition. ANAT 585 ANAT (PHARM) 585 Human Anatomy and Development B: Human Development (1) This course will provide a concise but thorough description of embryology of the major systems in the human. It will provide an awareness of how genetics, environment, and maternal-fetal relationships impact on normal human development, and the importance of understanding embryology for biomedical and translational research. An emphasis will be placed on the role of molecular biology in normal embryology and human development. Primary literature will be consulted for a description of major signaling pathways and key signaling molecules associated with each system. Some discussion of abnormal development will be included.

ANAT 586: Human Anatomy and Development C: Stem Cell Biology and Regenerative Medicine

1 Credits

Exploration of stem cell biology and the role of stem cells in regenerative medicine. ANAT 586 ANAT (PHARM) 586 Human Anatomy and Development C: Stem Cell Biology and Regenerative Medicine (1) This course will provide an evaluation of stem cell biology and regenerative medicine. In particular, discussions will focus on the five sources of embryonic stem cells (adult stem cells, amniotic fluid-derived stem cells, embryonic stem cells derived using in vitro fertilization technologies, somatic cell nuclear transfer cloning-derived stem cells, and stem cells derived by parthenogenetically-activating oocytes). In addition to providing detailed information on the biology underlying stem cells, group discussions will focus on ethical advantages and disadvantages for each of the five distinct types of stem cells. Work will then turn to current understanding of changes in transcriptome and proteome control of differentiation. As well, discussions will focus on attempts to use stem cells in regenerative medicine. This course will be designed as a mixture of didactic lectures with a particular focus on the current literature. This latter aspect of the course is essential in that much of our current understanding of stem cells has not yet made it into any common text books.

ANAT 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

ANAT 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

ANAT 597: Special Topics

1-9 Credits/Maximum of 999

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

ANAT 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

ANAT 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

ANAT 602: Supervised Experience in College Teaching

1-6 Credits/Maximum of 99

Supervised experience in the development of instructional materials, the organization and conduct of lectures/laboratories, the evaluation and counseling of students.

ANAT 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

ANAT 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

Animal Science (ANSC)

ANSC 500: Current Issues in the Animal Sciences

2 Credits/Maximum of 2

Exploration of current controversial issues and impactful innovations in animal agriculture with a focus on their discovery and future applications. Students will develop an understanding of the contribution of seminal research papers that changed paradigms in the Animal Sciences and develop a deeper understanding of the scientific method and its potential impact on the world.

ANSC 501: The Ethics of Scientific Scholarship

2 Credits

Consideration of the scientific method relative to scholarship and the ethical issues faced by scientists. Fulfills the students' Discussion-based Education SARI requirement.

ANSC 502: Grantsmanship

2 Credits

Consideration of the scientific method relative to grantsmanship, including formulation of hypotheses, objectives, experimental design, development of a complete grant proposal, and the peer review process.

ANSC 503: Professional Skills for Graduate Students

2 Credits

This course will be focused on four main areas: project management, reproducible science, soft skills, and preparation for the job market. Students will be given an overview of strategies and tools that can be used to improve the execution of their scientific projects. Those

concepts will then be put into practice through the development of management, data analysis, and publication materials using students' current or proposed projects. Hands-on sessions will include the financial reality of carrying out a scientific project, and the application of tools designed to improve science reproducibility, transparency, and data sharing. Finally, students will prepare materials that will be useful for future job applications. The course will provide students with important skills needed for a successful graduate school experience that are fundamental, but often not formally taught. Students will receive training in aspects of project management, reproducible science, communication, networking, and career preparation.

ANSC 504: Communication of Scientific Information

2 Credits

Development of skills in scientific writing and speaking, including preparation of manuscripts, scientific posters and technical documents, and design and delivery of oral presentations (e.g., platform talks, webinars, seminars).

ANSC 506: Ruminology

3 Credits

Physiological, biochemical, and microbiological activities occurring within the rumen and the relation of rumen function to animal response.

Prerequisite: at least one course in each of the following areas: animal nutrition, physiology, microbiology, and biochemistry
Cross-listed with: NUTR 506

ANSC 515: Advanced Physiology of Reproduction in Farm Animals

1-6 Credits

Advanced physiology of reproduction in farm animals.

Prerequisite: 3 credits each of reproductive physiology, systemic physiology, and endocrinology

ANSC 543: Animal Genomics

3 Credits

Foundations in genomics, proteomics, epigenomics, and basic bioinformatics, and their applications in animal breeding, health, production, reproduction, nutrition, and medicine. AN SC 543 Animal Genomics (3) Genomics is a branch of genetics concerned with the study of genome sequence, assembly, and analysis of the structure and function of genomes. It is an interdisciplinary field involving the marriage of molecular biology, robotics, and computing. The course is designed to foster an appreciation for the importance of genomics as applied to animal agriculture and medicine and to provide a knowledge base that enables students to successfully move on and master advanced topics in genomics. Additionally, the course will introduce students to approaches and techniques used to sequence and analyze animal genomes and provide a hands-on learning environment to familiarize students with genome databases and basic bioinformatics tools. The course will combine lecture discussion of current literature with hands-on genomic analysis with focus on genome structure & organization, genome sequencing & annotation, animal genome projects & comparative mapping, single nucleotide polymorphism (SNP) discovery & genome-wide association study (GWAS), genomic selection, non-coding RNA, microarray analysis, proteomics, epigenomics, phylogenomics, and systems biology. Each topic will have one or more computer-based lab

sections that are designed to provide students with further information related to the topic, with a particular focus on how to navigate genome databases and how to carry out basic bioinformatics analysis for their research projects. This course is suitable for graduate students, professional research scientists, and any student who has a BS in life science and wants to learn more about animal genomics and its sub-disciplines.

ANSC 590: Colloquium

1-9 Credits/Maximum of 9

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

ANSC 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

ANSC 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

ANSC 598: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

ANSC 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

ANSC 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

ANSC 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Experience in developing, organizing, and conducting lectures/laboratories; evaluation and counseling students and related resident education activities.

ANSC 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

ANSC 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

Anthropology (ANTH)

ANTH 508: Visualizing Anthropological Data

3 Credits

Recommended Preparations: STAT 500; STAT 511; Or a standard introductory statistics course or an equivalent course at the student's previous institution. Anthropology is a four-field discipline comprising dozens of sub-disciplines, each one characterized by particular theoretical and methodological approaches. As a consequence, the data that anthropologists regularly collect, analyze, and display are diverse in nature, scale and complexity. The purpose of this course is to expose anthropology graduate students to the field's wide range of approaches for managing and visualizing anthropological data. Course content will focus on ways of organizing, analyzing, and representing anthropological datasets. Lectures, practicums, and discussion will center on the criteria and rationale behind visual representations and how these are related to research questions, hypotheses, models, and goals.

ANTH 509: Proposal Writing

3 Credits

This course provides practical training and experience in proposal writing and revisions for graduate students in anthropology and related disciplines.

Prerequisite: STAT 451

ANTH 521: Current Literature in Archaeology

1 Credits/Maximum of 1

Seminar designed to expand general knowledge of archaeology through exposure to current research and related issues in contemporary archaeology. ANTH 521 ANTH 521 Current Literature in Archaeology (1) This seminar is designed to expand general knowledge of archaeology through exposure to current research and related issues in contemporary archaeology. We accomplish this by examining the best of recent journal literature. We may also occasionally read a chapter from an edited book. We will normally read and discuss one article per week, although we might increase that number in cases where articles have been followed by published debates. Articles should be selected from a list of approved journals that will be supplied in class. Each article must be approved in advance by the course professor. The presenter should follow the standard outline for article discussion that will also be supplied in class. Faculty: Frances Hayashida, Kenneth Hirth, George Milner, Dean Snow, and David Webster

ANTH 541: Current Literature in Integrative Anthropology

1 Credits/Maximum of 6

This course (Journal Club) is a survey and discussion of recent, cutting-edge research papers across anthropology, including human ecology, archaeology, biological anthropology, and especially on work that is integrative among these areas of research and/or connects to other disciplines. This course will provide students with experience in making

critical evaluations of the use of theory, method, and analysis in the field of anthropology.

ANTH 545: Seminar in Anthropology

1-9 Credits/Maximum of 9

Critical analysis of research in selected areas of anthropology.

ANTH 556: Social Organization of Traditional Societies

3 Credits

Cultural bases of social organization of traditional societies.

ANTH 559: Human Ecology

3 Credits

Within the anthropological and environmental sciences, human ecology (incorporating environmental anthropology, ecological anthropology, cultural ecology, behavioral ecology and evolutionary ecology) is the study of dynamic interactions between people and the environment, past and present. The readings are designed to give students an overview of the fundamental ecological processes that pattern human behavioral responses to environmental variability and how and why human behavior recursively shapes environmental variability. These incorporate a wide range of topics with an emphasis on how human social behavior and resource use are integrated into ecological processes and their services at multiple scales. In so doing, the course takes a holistic perspective of the human experience; one that views cultural, biological, environmental, demographic, and technological processes as interconnected phenomena, and human behavior and practices as components of complex adaptive systems. The topics covered are especially timely in our contemporary political and environmental context, and will explore the relevance of human ecology for these on-going debates.

ANTH 560: Ecology, Evolution, and Human Behavior

3 Credits

This course provides fundamental theory to understand the nature of the dynamic relationship between human decision-making and the natural and social environment. We focus on ecological anthropological theory operating at multiple scales, from the individual to the population, to the community. We will learn how such theory has been applied in the development of a wide range of questions in ecological anthropology, with a focus on key empirical studies of resource use and reproduction, population growth, subsistence and social intensification, disturbance dynamics, niche construction, and cooperation.

ANTH 562: Laboratory Methods in Anthropology

3-9 Credits/Maximum of 9

Supervised laboratory research, utilizing materials from physical anthropology or archaeology or cultural anthropology.

ANTH 563: Current Literature in Biological Anthropology

1 Credits/Maximum of 1

Seminar designed to expand general knowledge of Biological Anthropology through exposure to current research and issues in contemporary Biological Anthropology.

ANTH 566: Infectious Diseases in Anthropological Populations

3 Credits

Surveys infectious diseases in history and prehistory; introduces concepts from microbiology, immunology, and epidemiology, applies them to past human populations. ANTH 566 ANTH 566 Infectious Diseases in Anthropological Populations (3) Throughout history, more people have died of infectious diseases than of any other causes. Such diseases are therefore of great importance in human ecology and demography. Yet anthropologists have paid scant attention to the implications of infectious diseases for human populations, especially populations in the past. This course attempts to correct that oversight. The course is designed for graduate students and advanced undergraduates in anthropology and related fields (biology, population studies, health sciences). The primary focus will be the role of infectious diseases in human population ecology, but enough background will be provided on the biology of infectious diseases to make the course as self-contained as possible. Thus, we will review basic information about the biology of pathogen-host interactions, including some elementary microbiology and immunobiology. (Note that the course is not intended to replace introductory-level courses in those fields.) We will also discuss the evolutionary arms race between the human host and its pathogens, especially in the evolution of pathogen virulence. Once this basic background has been provided, the remainder of the course will deal with infectious diseases in past human populations. What was the role of infectious diseases in population regulation? How did human population structure affect infectious disease dynamics? How did infectious diseases contribute to the mortality "crises" that are known to have affected many preindustrial societies? To address these questions, we will review recent insights based on mathematical models of the epidemic process. The focus will not be on the mathematics per se—indeed, students need not have any special mathematical background. But they will be expected to learn Stella, a computer language for dynamic modeling. (Stella was chosen because it is easy to learn, and yet allows construction of sophisticated models without requiring any attention to the underlying math.) Toward the middle of the semester, students will break into 2-4 groups, each of which will select a particular disease or class of diseases, develop some models of them using Stella, and present the results to the class as a whole. The entire class will then work together to explore and extend the models developed by the separate groups. Grading will be based on the group presentations, in which all students are required to participate. Participation in general classroom discussion will also be taken into account. Since the class will combine formal lectures with a more seminar-like format, active student participation is essential for a good grade. This course will be offered once a year with an enrollment of 15.

ANTH 571: Principles of Human Evolutionary Biology

3 Credits

Mechanisms and quantification of human genetic variation and survey of evolutionary aspects of human ecology, life cycle, and population biology.

ANTH 572: Advances in Anthropological Methods

3 Credits

This lecture-based course will provide exposure to current data collection methods and analyses in integrative anthropology research, and offer specific examples of application. The course will focus especially on the creative application of newly available technologies to help address major outstanding issues in biological anthropology, or on how the

combination of traditional approaches and modes of data collection with advances in computational or statistical analysis can advance the field. Research design issues, data limitations and computational analysis requirements, and anticipated future developments will be considered for each method and subject area combination. Students will be exposed to the challenges, limitations, and processes of ultimately successful research studies and programs, to provide a practical awareness and guidance towards the development of their own research projects and careers in anthropology.

ANTH 573: Anthropology Research Practicum

3-12 Credits/Maximum of 12

This course will provide a structured and supervised research experience to first-year students in the anthropology graduate program, providing both 1) hands-on exposure to anthropological laboratory and/or analytical methods, and 2) related professional development preparation to benefit the students' ongoing graduate training and future research careers. Specifically, with the help of anthropology faculty, students will identify a suitable, rotation-type research experience that can be conducted reasonably over the course of the semester. Meanwhile, the classroom experience will involve discussions on the research-related topics most relevant to the students' level of training and development. Likely topics include the development of research questions and study designs, power calculations, tools and strategies for literature survey, research funding options and strategies, data management and archiving, publication formats and journal outlets (including preprint servers), the publication preparation/submission/review process, academic conferences and traditional and non-traditional networking opportunities (including the effective use of social media), effective structures for research presentations in both poster and podium formats, and scientific outreach opportunities. Students will also read papers relevant to their research interests, and update the class regularly on the progress, challenges, and learnings from their ongoing research experiences/projects.

ANTH 575: Population, Food, and Traditional Farming

3 Credits

This course explores the relationship between demographic processes (fertility, mortality, migration) and traditional farming, especially farming near the subsistence level. ANTH 575 Population, Food, and Traditional Farming (3) This course explores the complex relationship between demographic processes and traditional agriculture. It starts with the premise that traditional agriculture, at least agriculture near the subsistence level, is primarily demographic in its motivation: the main purpose of a small-scale, preindustrial family farm is to create and support a family, i.e. produce children (fertility) and keep them alive (survival). This idea will be the starting point for re-examining existing theories about population and agriculture, and for formulating new models of the traditional farming household as a demographic enterprise. Some of the topics to be addressed include: (1) the slippery concepts of 'population pressure', 'over-population', 'population regulation', 'carrying capacity', and 'sustainability'; (2) some basic ecology and economics of subsistence production and consumption; (3) the debate over agricultural intensification; (4) the effects of under-nutrition on fertility and mortality; (5) the nature of the household labor force; (6) the household demographic life cycle and its economic implications; (7) seasonality and the allocation of household labor; (8) the demography of the 'hungry season' (9) risk management and food shortages; and (10) household wealth differentials and their demographic implications.

The first half of the course will be in lecture format, the second will be more like a seminar. At about the mid-point of the semester, students will split into groups of 2-4 (depending on class size). Each group will select an ethnographic/demographic/economic monograph on traditional agriculture from a list provided by the instructor, prepare and present a PowerPoint presentation on it, and lead an extended classroom discussion of it. Each presentation ought to take up at least two or three class periods. The course grade will be based on the presentation and on general seminar participation (approximately 80 percent presentation and 20 percent participation, including doing the required readings). This course should appeal to graduate students and advanced undergraduates in anthropology, geography, crop and soil science, demography, rural sociology, agricultural economics, and behavioral ecology.

Prerequisite: ANTH 408

ANTH 579: Spatial Demography

3 Credits

This graduate course will expose students to spatial analysis tools and analytical methods applied to demographic research. ANTH (SOC) 579 Spatial Demography (3) The improved application of spatial data and methods to demographic research is a critical methodological challenge facing demographers today. This graduate seminar is designed to focus on substantive demographic research topics while exposing sociologists and demographers to challenges in, and opportunities for, using geographic information systems (GIS), spatial analysis, and spatial statistics in their own research. Substantive foci will include readings and discussions of spatial perspectives on topics such as racial/ethnic segregation, spatial mismatch/entrapment, poverty, crime/delinquency, migration, health inequalities, wellbeing, maternal and child health, environmental justice, and population and environment relations. Similarly, the seminar will highlight connections between spatial concepts and data availability (e.g., Modifiable Areal Unit Problem - MAUP; data privacy), other emerging methodological approaches to studying society (e.g., contextual modeling, multi-level modeling and the area of neighborhood effects) as well as the integration of different types of data (e.g. qualitative data and quantitative data). Throughout the course lectures and discussions will be complemented with lab sessions introducing spatial analysis methods and GIS and spatial analysis software. The lab sessions will include the use of among other software GeoDa, CrimeStat, R, and ArcGIS (including Geostatistical Analyst and Spatial Analyst extensions). These lab sessions will introduce many methodological and technical issues relevant to spatial analysis (e.g., error, data validation, data integration, cartography, exploratory spatial data analysis, spatial regression modeling, geographically weighted regression, point pattern analysis and geostatistics). Assignments for the courses include up to two writing assignments, up to four lab assignments, and a final project which will be presented as a short 15-minute presentation as well as submitted as a term paper. The writing assignments will include an annotated bibliography/brief literature review within a selected demographic theme area and a profile of a well-known demographer and their adoption of spatial thinking/perspectives/methods. The lab assignments will focus on building geospatial databases, basic spatial analysis, exploratory spatial data analysis, and spatial regression modeling. The courses will include other labs and assignments that will be completed for no grade; these are intended as mechanisms/opportunities for developing and enhancing familiarity with selected software, data resources, and analytic methods.

Prerequisite: Graduate course in statistics, i.e., SOC 574 or ANTH 509

Cross-listed with: SOC 579

ANTH 588: Method and Theory in Archaeology

3 Credits

Methodological strategies and tactics in archaeological research; major theories in cultural anthropology as applied to archaeological data.

ANTH 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

ANTH 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

Prerequisite: prior approval of proposed assignment by instructor

ANTH 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

ANTH 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

ANTH 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

ANTH 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Supervised experience in teaching and orientation to other selected aspects of the profession at the Pennsylvania State University.

ANTH 603: Foreign Academic Experience

1-12 Credits/Maximum of 12

Foreign study and/or research constituting progress toward the degree at a foreign university.

Applied Behavior Analysis (ABA)

ABA 500: Science and Behaviorism

3 Credits

This course will provide students with a foundation in the assumptions and philosophies of Applied Behavior Analysis. Students will learn about the development and advancement of behavioral theory. Special emphasis will be placed on the application of behavioral theory to

problems of social significance and research-based clinical practice. Finally, considerations for extending behavioral theory beyond traditional areas of application will be discussed throughout the course.

ABA 510: Behavioral Assessment and Intervention: Functional Skills

3 Credits

This course will provide students an overview of the foundations and applications of evidence-based practice for teaching functional skills across ages, environments, and types of skills. Students will learn how to identify and apply evidence-based practices to teach clients and stakeholders. Special emphasis will be placed on behavioral assessment, behavior-change procedures, and selecting and implementing interventions. Finally, considerations and guidelines related to approaching functional skill instruction and the synthesis of evidence-based practice and research will be discussed throughout the course.

Recommended Preparation: Students are recommended to take ABA 522 and ABA 533 prior to taking this course.

ABA 511: Behavioral Assessment and Treatment

3 Credits

This course provides students with the research-based principles and procedures of applied behavior analysis. The course teaches students how to review research-based procedures, analyze, interpret, and develop research-based intervention programs for a wide range of populations and behaviors. The course provides advanced discussion on the empirical and theoretical underpinning of behavior intervention procedures.

ABA 512: Behavioral Assessment and Intervention: Problem Behavior

3 Credits

This course will provide students an overview of the foundations and applications of evidence-based practice for reducing problem behavior. Students will learn how to identify and apply evidence-based practices to reduce problem behaviors. Special emphasis will be placed on behavioral assessment, behavior-change procedures, and selecting and implementing interventions. Finally, considerations and guidelines related to approaching reduction of problem behavior and the synthesis of evidence-based practice and research will be discussed throughout the course.

Recommended Preparation: Students are recommended to take ABA 522 and ABA 533 prior to taking this course.

ABA 522: Behavioral Research Methods

3 Credits

This course will examine the multiple facets of behavioral research and single-case design. Students will learn to conduct single-case design research and critically evaluate published behavioral research to apply to their own research. Special emphasis will be placed on the analysis, strategies, tactics, and application of single-case experimental research methodologies related to research-based clinical practices. Finally, the ethical implications of the aforementioned areas will be discussed throughout the course

Prerequisite: enrollment in the Applied Behavior Analysis program or permission of instructor

ABA 533: Principles of Behavior Analysis

3 Credits

This course will provide students with a foundation in the concepts, principles, and techniques of Applied Behavior Analysis. Students will learn about the relationship between behavior and environment and the variables that influence behavior and affect meaningful change. Special emphasis will be placed on the application of learning principles related to research-based clinical practice. Finally, considerations and guidelines for the use of behavioral techniques and principles will be discussed throughout the course.

ABA 534: Advanced Principles of Behavior Analysis

3 Credits

This course will provide students with a foundation in the experimental analysis of behavior. Students will learn the historical discovery of the principles of behavior described in basic and translational research and the contemporary application of experimental analysis. Special emphasis will be placed on the translation of research to inform research-based clinical practice. Finally, the implications of the experimental analysis of behavior on understanding behavior will be discussed.

Prerequisite: ABA 533 Principles of Behavior Recommended Preparation: Recommended preparation for this course includes completion of ABA 500 and ABA 522

ABA 544: Behavioral Systems Support

3 Credits

ABA 544 Behavioral Systems Support concentrates on personnel supervision and management knowledge with additional components of skill training. The class will include the research/evidence-based practices for behavioral system-wide instructional techniques, personnel management, and supervisory methodologies. Within the course, students will be exposed to evidence-based behavioral staff training methodologies for a variety of environments (e.g., group home, business, health, educational, etc.), behavioral skills training for parents/caregivers, and training methodologies within organizations. Behavioral research-based personnel and behavior-analytic supervisory management related to staff management, behavioral treatment integrity, performance management (e.g, assessment, expectation, and feedback), ethics, and functionally-based assessment and performance feedback will be taught.

Prerequisite: ABA 511; ABA 533

ABA 555: Behavioral Intervention in Autism & Developmental Disabilities

3 Credits

For many decades, behavior analysis has contributed significantly to the understanding and treatment of autism and related developmental disabilities. This course will provide students with the knowledge and skills needed to work with individuals with autism and related developmental disabilities not only in early intervention efforts but across the entire spectrum of settings, age ranges, and developmental levels. Autism and related developmental disabilities will be addressed in terms of assessment, education, and treatment. Some specific areas targeted that are characteristic of autism will include language, social skills, self-injury, sleep disorders, and stereotypic behavior. Some specific educational strategies emphasized will include discrete trial training,

incidental teaching, prompting and fading. The students will gain a knowledge of the major issues related to the use of behavior analysis with individuals with autism and related developmental disabilities including education issues such as due process and inclusion and legal and ethical issues surrounding the certification of behavior analysts. Students also will learn how to evaluate the research related to various treatments and educational practices for autism.

Prerequisite: enrollment in the Applied Behavior Analysis program

ABA 566: Behavioral Pediatrics

3 Credits

ABA 566 Behavioral Pediatrics provides an overview of behavioral pediatrics and discusses the role of Behavior Analysis within this field. Behavior analysis significantly contributes to the field of behavioral pediatrics. This course will provide an overview of behavioral pediatrics and evaluate research related to operant contingencies in infant, child, and adolescent learning, social development, and behavioral/medical pediatric issues. Research-based behavior analytic interventions and change procedures also will be assessed and evaluated as they apply to skill development, behavioral reduction, medical compliance and adherence, and behavioral interventions for medical/behavioral issues. Behavioral approaches to health promotion and injury prevention will be discussed.

Prerequisite: ABA 511; ABA 533

ABA 577: Case Conceptualization and Development

3 Credits

The purpose of this course is to give students an overview of case conceptualization and development according to the foundations of behavior analysis. The course will include behavior assessment foundations related to types of behavior assessment and their relationship to the development of research-supported treatments. Students will be asked to learn ABA assessment methods to evaluate specific behavior within broad diagnostic categories, develop data analysis methods based upon ABA research, and analyze and justify behavior treatment decisions based upon research.

Prerequisite: ABA 511; ABA 533

ABA 588: Ethics in Research and Professional Practice

3 Credits

This ethics course will provide students with an overview of ethical and legal issues related to applied behavior analysis research and practice. Students will learn the current Behavior Analysis Certification Board's ethics standards, review the application of ethical practice and research codes, apply ethical research and codes to ethical situations, and identify and develop possible new ethical issues and guidelines.

Prerequisite: enrollment in the Applied Behavior Analysis program or permission of instructor

ABA 594: Research Topics

1-15 Credits/Maximum of 18

Supervised student activities on research projects identified on an individual or small-group basis.

ABA 594A: RESEARCH TOPICS

1-9 Credits/Maximum of 18

Supervised research project in behavior analysis for degree candidates.

ABA 595: Internship

1-18 Credits/Maximum of 18

Supervised off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

Prerequisite: prior approval of proposed assignment by instructor

ABA 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

Applied Demography (APDEM)

APDEM 801: Principles of Demography

3 Credits

This course examines fundamental concepts and ideas in Demography, and U.S. and world population trends associated with these concepts. APDEM 801 Principles of Demography (3) This course provides an overview of demographic research and scholarship as a basis for the Applied Demography certificate and the Masters in Professional Studies degree in Applied Demography. The scope of the course content is broad, rather than in-depth, covering central disciplinary concepts and associated key theoretical ideas and empirical population trends. In particular the course investigates topics such as population growth, transitions in family patterns, fertility patterns and policy, immigration and growing population diversity, race and ethnic population inequality, internal migration and residential segregation, health and mortality patterns, population aging, and economic well-being and the environment. Building on insights from the study of the above topics, students conduct a comparative population analysis of a developed vs. developing country or of two regionally dispersed U.S. states using census and vital statistics demographic data to document five or more key over-time population trends. Results from this analysis are then used to address applied demography questions about the relationships with outcomes for either business demography or public policy demography. Students will learn fundamental disciplinary concepts, central theoretical scholarship ideas, major empirical U.S. and world population trends, and experience a hands-on skill-enhancing population data analysis project which integrates knowledge and application learning.

APDEM 802: Data, GIS, and Applied Demography

3 Credits

This course provides an overview of key demographic data sets, and promotes familiarity with, and appropriate use of, these data. This course offers a comprehensive introduction to the wide variety of different government (and commercial) data sets that are among the most frequently utilized by practicing applied demographers. While US data sets are emphasized throughout the course international data products also will be discussed. Raw population data needed for demographic

research comes from a variety of sources. The course will introduce students to the fundamental principles and design considerations of the different types of data collection systems that are used: censuses, 'rolling' censuses, surveys, vital statistics and administrative records. While contemporary issues are often studied using the latest available data many demographic questions necessitate the inclusion of a historical perspective (e.g., studies of population change) and as such linking and analyzing data across time also will be discussed. The analytical sections of the course will focus on the strengths and limitations of data products (e.g., including issues of data reliability and appropriate data use). A review and discussion of future directions in data collection and data sources wraps up the course. Enormous amounts of demographic data are now made available in aggregate form for geographical units (neighborhoods, cities, counties, states). These aggregate data are of interest in their own right but also are increasingly relevant to questions related to the role of geographic context on individual-level demographic outcomes. In this course students will learn about nested and non-nested geographical hierarchies of different data products and fundamental principles for handling and analyzing geospatial demographic data (e.g., how and when data sets can be linked together, how to visualize demographic data, spatial coverage, the influence of scale, and how to detect, and the consequences of, spatial dependence). This is a hands-on applied course in which students will be expected to access, understand, manage, and analyze different kinds of demographic data sets. The emphasis on data interpretation and analysis will be on descriptive statistical analysis, data visualization, and exploratory spatial data analysis using open source and/or available software.

APDEM 803: Applied Demography in Practice

3 Credits

This course provides an overview of applications in applied demography in business, non-profit organizations, public policy, and health; including a focus on international applications. Students will learn to apply critical and analytic skills to case studies, identify the most appropriate data sources and methods to help solve practical problems (e.g., business siting; school redistricting; emergency evacuation; labor market projections; relief efforts). Emphasis throughout will be on recognizing and reinforcing best practices in the use, linkage, and interpretation of data in real world situations.

APDEM 804: Business Demography

3 Credits

This course provides a broad coverage of business demography questions that draw upon knowledge, data, and methods associated with applied demography. The course begins with an overview of the goals of business demography applications, major data and methods, and mega population trends that address practical problems in business. The course addresses several key topics in business demography. Part 1 focuses on the application of local and national population characteristics and dynamics to target consumer behavior marketing and market segmentation. The analysis of demographic data integrated with consumer characteristics data is fundamental to corporate decision making on generational marketing strategies. Part 2 analyzes the impact of demographic factors on business site selection, notably population growth trends and the human capital characteristics of local area labor markets. Integration of current and projected population characteristics with sales data informs local, national, and world business site selection decisions. Part 3 focuses on the impact of mega demographic trends

in population size, growth, characteristics, and dynamics on corporate investment strategies in local labor markets, states, nations, and international locations. Part 4 examines within-corporation human resource management problems involving the demography of work force size and characteristics. Worker population entry, turnover, and the flow of individuals through positions in the workplace are analyzed. Part 5 focuses on the interface between demographic characteristics of business client and worker populations and compliance with local, state, and national regulations in the conduct of business. Issues of business non-discrimination and the dynamics of community population characteristics are considered. This course covers a diverse set of topics related to business and corporate activities. It provides students with a substantive understanding of key business demography topics and the population data and analytical tools to help them address practical problems faced by business decision makers. The course concludes with a consideration of possible newly emerging applied business demography issues and future data challenges and opportunities.

APDEM 805: Public Sector Demography

3 Credits

This course provides an analysis of selected public sector, non-profit, and public policy demography issues that draw upon knowledge, data, and methods associated with applied demography. The course begins with an overview of the goals of public sector demography applications, major public data sources and methods, and mega population trends that address practical problems in the public sector. The course addresses such topics as the following: Part 1 focuses on the impact of area population characteristics and change on the allocation of public program resources. Changes in current and projected target population groups in local, state, and national areas is a key factor in public infrastructure and program funding as well as human service program planning. Part 2 focuses on the impact of cohort population change for elementary, secondary, and college educational system planning. Understanding school enrollment population projection techniques is fundamental in this area of applied demography. Part 3 examines the demographic dynamics of agency client populations and within-organization work force size and characteristics. Worker population entry, turnover, and the flow of individuals through public sector and non-profit organization workplaces are topics of interest. Part 4 focuses on population data and trends that are the bases for apportionment of governmental representation among areas and population groups. Redistricting area populations for voting equity is an important local, state, national, and international applied demography issue. Part 5 examines the interface between area population characteristics and change and compliance with local, state, and national non-discrimination policy regulations related to public program activities, such as law enforcement, school administration, etc. This course covers a diverse set of topics related to public sector, non-profit, and public policy organizational activities. It provides students with a substantive understanding of key applied demography issues of interest to public sector administrators and governing boards. The course concludes with a consideration of possible newly emerging applied public sector demography issues and future public data challenges and opportunities.

APDEM 806: Applied Demography & Health

3 Credits

This course provides an overview of data, methods, and techniques in applied demography used to help address public health questions. This course provides a wide-ranging coverage of substantive health

questions that draw upon data and analytical methods closely associated with applied demography. The course opens with an overview of the substantive connections between health and applied demography.

The remainder of the course is divided up into three main parts: (1) Local/Regional Health Assessments; (2) Methods and Case Studies in Morbidity and Mortality; and (3) Emergent Trends in Applied Demography and Health. Part 1 focuses on data needs and commonly used methods (and their limitations) related to local/regional community health assessments - including diverse contexts (rural-urban, developed and developing countries). These data and methods are utilized to examine health disparities, health service planning (based on catchment area analysis and location-allocation modeling as well as methods for measuring accessibility and utilization of health services), environmental pollution, and emergency/disaster response. Part 2 covers the connections between demographics and the epidemiological transition. This section includes a broad focus on a specific classification of human health and disease (i.e., provisioning care and disease prevention, communicable disease, non-communicable disease, and accidents and other causes of injury and death). Across each classification of health and disease the heterogeneity of data needs, time scales, spatial scales, and population at risk is wide. Applications of methods and use of case studies will facilitate the discussion of these different kinds of contemporary health challenges. Part 3 focuses briefly on the future, including an examination of global health questions (broad processes and forecasts associated with migration, urbanization, and environmental change) and new types of data and methods (including challenges and opportunities) that applied demographers will likely use in the next decade. This course covers a diverse set of topics related to human health. Some of the most important health problems of the early 21st Century (in the U.S. and globally) relate to health inequalities in access to resources (e.g., access/use of health services) and in the variation in individual exposure to risks (e.g., environmental pollution, neighborhood deprivation, obesogenic environments, and crime), and how both access to resources and exposure to risk are associated with health disparities across populations (by race, socioeconomic status, gender, age, and other forms of social stratification). This course will provide students with an understanding of key health topics, and specific data and analytical tools that can be used to address them.

APDEM 807: Small Area Estimation

3 Credits

This course provides an overview of applications in small areas population estimation techniques used in public policy, business and academia, including case studies from the United States and other international programs. In particular, the course considers the growing needs of the public and private sector and non-profit organization to produce and disseminate quality disaggregated data on population that support public policy programming and business planning. It considers small area data sources and different methodological approaches to small area estimation. Building from relevant policy examples, students will conduct a review of classical design-base approaches and apply indirect and inference techniques using auxiliary information. Students will recognize, identify and apply, with diverse types of demographic and socio-economic data, small area estimation methods, using open source and/or available software. From these insights, students will also compare case studies based on data disaggregation and Big Data Analytics.

Recommended Preparations: APDEM 801, APDEM 802, SOC 579, and SOC 573

APDEM 808: Capstone Project

3 Credits

Students will utilize methods acquired during their program and apply them in a Capstone. This is a Capstone course and a requirement for all students in the M.P.S. in Applied Demography. During their final semester, students will work closely with a faculty adviser (selected to match the student on substantive and/or methodological expertise) on a self-selected applied demography-related project. The student is expected to draw on data and methods encountered during their prior course work. At the end of the semester the student will be required to make a formal peer presentation to other enrolled students and all their faculty advisers. The student also will be required to submit a final report/paper to their faculty adviser by the end of the semester. The format of the course will vary by student, their faculty adviser and the scope and nature of the Capstone project itself. The intent is that the student conduct an independent study-like project that results in a both a formal oral presentation and a written report.

Prerequisite: APDEM 801, APDEM 802, APDEM 803, SOC 573

Applied Linguistics (APLNG)

APLNG 500: Practice Teaching in ESL

3 Credits

Provides instructional support and professional mentoring for second language teachers during the practice teaching experience.

APLNG 510: Health and Aging in Multilingual Contexts

3 Credits

This course focuses on anthropological approaches to health and aging in multilingual contexts.

APLNG 512: Language and Adult Lifespan Development

3 Credits

The effects of adult cognitive development and decline on the production and comprehension of language in mono- and multilinguals. APLNG 512 Language and Adult Lifespan Development (3) This graduate seminar is designed to provide a theoretical and practical introduction to research on adult lifespan development and language processing among multilinguals. It will be offered every other year as one of the course options in language in society, an area of concentration for both the MA TESL and PhD in APLNG degree programs in LALS. This course is also part of a LALS sequence in Language, Health, and Aging. While the main draw will be graduate students in LALS, the course may be of interest to graduate students in bio-behavioral health, gerontology, and human development and family studies. The expected total enrollment is 15. Topics covered in course readings and activities include: theories of adult lifespan development and cognition; language processing among monolingual young, middle-aged, and older adults; multilingualism and adult lifespan development, with particular attention to the effects of aging on bilingual processing, second language acquisition, and language attrition; and research methods proper to cross-sectional and longitudinal studies of language development over time. Over the course of the semester, students will also plan, prepare, and conduct a quantitative experiment or qualitative study on one of these topics. Through participation in a variety of activities, students will 1) become familiar with the research literature on language processing and adult

lifespan development, with particular attention to multilingualism, 2) develop critical skills in interpreting and comparing cross-sectional and longitudinal research designs in adult development studies, 3) develop practical skills in conducting such research and analyzing the results. Evaluation of students includes three components: 1) weekly presentation of results from required readings, 2) participation in an empirical research project conducted by the group, 3) summary paper describing the results of that research project.

APLNG 530: Perspectives on African Language Research in the Global South

3 Credits

The innovations and challenges of the Global South extend beyond an agenda that redresses exclusions. Rather, these are deep-seated challenges to the core tenets of language research as well as new directions for theories and practices on language research in the Global South in general. A renewal of southern epistemologies requires an understanding of the absences such knowledge implies. To engage with the transformative potential of non-Eurocentric thinking, the course explores the relevance of a decolonial imagination that makes it possible to envisage an alternative reality and justice that engenders "radical hope." Topics central to the course are the decolonization of research methods, feministic perspectives on African languages, Southern Multilingualisms and education, digitization of African cultural practices, indigeneity, an engagement with "Indigenous cosmovisions," and reinvented traditional concepts, such as ubuntu or sumac kawsay, that suggest that the formation of other worlds is feasible. These newly reinvented cosmovisions render it feasible to move beyond the limitations of Western-centric politics and knowledge production. The course is far more than a critique of the Global North's scholarship. It will cultivate a decolonial imagination, consequently producing African language knowledge with the South, and not on the South.

Cross-listed with: AFR 530

APLNG 570: Second Language Reading

3 Credits

Theoretical and practical introduction to concepts, methods and practices of research and instruction of second language reading development. APLNG 570 APLNG 570 Second Language Reading (3) This graduate seminar is designed to provide a theoretical and practical introduction to the assumptions underlying and principles embodying a variety of approaches to second language reading development and instruction. In addition, it seeks to explicate the role of second language reading in the larger context of second language development. It will be offered every other year as one of the course options in language learning and teaching, an area of concentration for both the MA TESL and PhD in APLNG degree programs in LALS. While the main draw will be graduate students in LALS, the course may be of interest to graduate students in the foreign language departments and linguistics. The expected total enrollment is 15. Topics addressed in course readings and activities include: 1) the epistemological underpinnings of the notion of second language literacies; 2) psycholinguistic, critical and sociocultural approaches towards second language reading; 3) variables affecting second language reading performance; 4) strategies and instruction to influence second language reading development; 5) assessment of second language learners' reading performance, and 6) critical evaluation of instructional materials for a variety of second language learning contexts. Through participation in a variety of activities, it is expected that students will: 1) develop an understanding of second

language literacies, 2) develop critical understanding of the variables and processes involved in L2 reading, 3) develop a principled conception of L2 reading instruction, 4) integrate L2 reading into the broader disciplinary area of second language learning and L2 proficiency, and 5) develop practical skills of designing and evaluating L2 instructional materials. Evaluation of students learning includes the following components: 1) completion and discussion of required readings; 2) presentation of key instructional approaches; and 3) completion of a paper addressing a theoretical, instructional or research issue in second language reading.

APLNG 571: Usage-Based Approaches to Second Language Learning and Teaching

3 Credits

This course provides a broad exploration of usage-based approaches to second language learning and teaching. It considers the roles played by cognition, usage, and communication in shaping how we acquire, process, and use language and builds an awareness of language as a complex adaptive system that emerges gradually through usage. Building on these insights, participants will explore and critique foundations to contemporary research about the cognitive processes underlying language structure, language learning, and language teaching.

APLNG 572: Communication in Second Language Classrooms

3 Credits

The study of communication in second language classrooms. APLNG 572 APLNG 572 Communication in Second-Language Classrooms (3) This course focuses on investigating and understanding the dynamics of communication in second/foreign language instructional settings. Students will examine different variables that influence the nature of communication in second/foreign language classrooms including: teachers' control over the patterns of classroom communication, students' perceptions of the patterns of classroom communication, students' knowledge and use of language, and students' use of language for learning and second language acquisition. Each variable will be evaluated for its theoretical and pedagogical contribution to communication, learning, and second language development. In addition, through understanding the basic theoretical tenants of and actively participating in reflective teaching, students will examine, frame, and manage the dilemmas of classroom practice, become aware of and question the assumptions and values they bring to teaching, become attentive to the institutional and cultural contexts in which they teach, and recognize their responsibilities for their own professional development. Finally, students will be exposed to sociocultural perspectives on mediated language and literacy instruction and recognize their relevance for second language teaching, learning, and classroom communication. Faculty: Karen E. Johnson

APLNG 574: World Englishes: Pluralizing Policy, Pedagogy, and Proficiency

3 Credits

This course explores the global spread of English, the diversification of its norms, and their pedagogical and policy implications. APLNG 574 World Englishes: Pluralizing Policy, Pedagogy, and Proficiency (3) This course analyzes how the English language aids globalization and how globalization changes English. English now features multiple grammatical systems and norms in diverse speech communities, adopts new modes of literacy and discourse practices, and enters into fluid relationships with other languages and cultures. These changes call for

a reconceptualization of language standards, linguistic identities, literacy practices, and English language teaching. After studying the historical and geopolitical bases for the rise of English, the course explores the implications of contemporary forms of transnational relations, digital technology, and popular culture for diversifying the structure, norms, and usage of the English language. The course aims to develop in students a sensitivity to the changing norms in English, provide pedagogical resources for teaching English according to local repertoires, examine strategies for facilitating intercultural communication, and articulate policies on the role of English in a multilingual world. While students specializing in teaching English as a second language (TESL) will find this course useful to inform their teaching of English worldwide, doctoral candidates in applied linguistics will find it important to understand how the plural norms of English invite new research on issues such as language acquisition, discourse analysis, and sociolinguistic identities. The course will be of interest to students of English who are increasingly interested in the way World Englishes affect multilingual creative writing and composition practices. In addition, the course will be of interest to students in Education who have to address the diversification of English in the changing demography of students in national and international classrooms.

APLNG 575: Language Ideology

3 Credits

This course is designed to offer a range of perspectives on language ideology as an analytical construct.

APLNG 576: Language Socialization across Home, School, and Community Contexts

3 Credits

A survey of research on language socialization from a variety of sociocultural groups across a range of sociolinguistic contexts.

APLNG 577: Language Analysis

3 Credits

An overview of cognitive/conceptual/functional approaches to language analysis with applications to research, second language acquisition, and language pedagogy.

APLNG 578: Computational and Statistical Methods for Corpus Analysis

3 Credits

A hands-on introduction to the core and advanced computational and statistical methods for analyzing corpus data. APLNG 578 Computational and Statistical Methods for Corpus Analysis (3) This course will provide a hands-on introduction to the core and advanced computational and statistical methods for analyzing corpus data. Topics to be covered include basic UNIX tools and python scripting for text processing; state-of-the-art computational tools for automatic and computer-assisted corpus compilation and annotation; computational tools for querying and analyzing raw and linguistically annotated corpora; and statistical methods used in interpreting information extracted from text corpora. Prior experience in computational and statistical analysis is not assumed. By the end of the course, students will be expected to have a good grasp of the computational and statistical techniques necessary for processing, annotating and analyzing corpus data, and to be able to implement these methods in their own corpus-based research projects. This course will be highly applied, and there will be substantial

opportunities for demonstrations, exercises, and discussions. Students will be evaluated on participation in in-class activities and discussions, completion of a series of lab assignments designed to help them practice the computational and statistical techniques introduced, and a final research project. This course serves as the methods component of the two-course sequence in corpus linguistics offered in the Department of Applied Linguistics.

APLNG 579: Seminar in Applied Corpus Linguistics

3 Credits

This graduate seminar is designed to expose students to a wide range of corpus-based studies to answer questions of interest to applied linguists and language educators. We will examine studies that use large text corpora for describing and analyzing native and learner language from diverse perspectives as well as for language teaching and learning, focusing on theoretical, methodological, and empirical/pedagogical issues. Students will develop hands-on skills applicable to research topics of their own interest. Previous knowledge of corpus linguistics or a programming language is not assumed.

APLNG 580: Proseminar in Applied Linguistics

1 Credits

This team-taught seminar introduces PhD students to the scholarly areas and research perspectives in Applied Linguistics represented by department faculty. APLNG 580 Proseminar in Applied Linguistics (1) This team-taught pro-seminar is the cornerstone of the PhD program in Applied Linguistics. Its aims are to foster an intellectual community among incoming PhD students and department faculty and to provide the students with an overview of the scholarly expertise and research perspectives in Applied Linguistics represented by department faculty. The areas to be covered include: second and foreign language and literacy development and pedagogy; technology and language learning; language testing and assessment; language policy and planning; language uses in community, workplace, professional and academic settings from local, national, and international perspectives; language and identity; language and health; sociocultural theory; discourse and conversation analysis; and corpus linguistics. This is a required course for those entering the PhD program in Applied Linguistics and will be offered every fall. The enrollment will depend on the number of admitted students to the PhD program with a maximum number of 10. Through participation in discussions with individual faculty members, and readings when appropriate, it is expected that students will become familiar with 1) the scholarly expertise of the participating faculty members and 2) key concepts and research perspectives associated with their areas of specialization in the field of Applied Linguistics. Evaluation of student learning includes completion and discussion of readings. The department's Director of Graduate Studies will be responsible for scheduling the weekly meetings, for collecting feedback from individual faculty members on student contributions/performance and for assigning grades to students.

APLNG 581: Discourse Analysis

3 Credits

Overview of theories and approaches to the analysis of spoken and/or written discourse. APLNG 581 APLNG (CAS) 581 Discourse Analysis (3) This course is designed to provide an overview of the various theories of and approaches to the analysis of spoken and written discourse, e.g., speech act theory, conversation analysis, pragmatics, contextual

analysis, functional/cognitive grammar, grammar and interaction. These and other approaches are intended to serve as analytic tools and frameworks for students to ultimately design and carry out their own research projects within the course of the semester. Research projects may focus on any aspect of language use, such as language and grammar, language and interaction, language and culture, language socialization, language and cognition; projects may center on some phenomenon of English or may involve other languages, as long as the student is capable of conducting an in-depth analysis of the particular phenomenon under investigation in that language.

Cross-listed with: CAS 581

APLNG 582: Seminar in Approaches to Language Use

3 Credits

Examines the historical and contemporary landscape of research on language use.

APLNG 583: Methods of Language Assessment

3 Credits

Introduces methodology for selecting, developing, applying, and analyzing tests and questionnaires for research and evaluation in communication and language education. APLNG 583/APLNG 583 Methods of Language Assessment (3) This course introduces standard methodology for selecting, writing, and analyzing language tests and research questionnaires. Major focus will be given to reliability and validity issues and the study of current testing research paradigms. Course activities will include reading texts and articles, completing assigned exercises, writing and analyzing a testing/questionnaire instrument, and the preparation and presentation of a research paper reporting test development findings or addressing an approved assessment issue. The course is aimed at promoting the skills necessary to be effective judges and developers of language tests. This will involve learning to conduct item analyses, to understand principles of classical and item response measurement theory, to appreciate current and past language assessment issues, to carry out appropriate statistical analyses by computer or calculator, and to produce assessment research of publishable quality. In addition, the course will provide introduction to issues in latent trait/item response theory, item banking, computer adaptive testing, and instructional program evaluation. Faculty: Karen Johnson

APLNG 584: Sociocultural Theory and Second Language Learning

3 Credits

The course is an introduction to research on second language learning from a sociocultural theoretic perspective. APLNG 584/APLNG 584 Sociocultural Theory and Second Language Learning (3) The course is designed to be a graduate level introduction to research on second language learning and teaching informed by sociocultural theory of mind and cognitive development. The course will initially focus on the general principles of the theory as laid out in the writing of L. S. Vygotsky, his colleagues and modern interpreters of the theory. It will then consider in detail the research that has been carried out over the past 15 years on L2 learning and teaching from a sociocultural perspective. Topics to be covered include the following: a brief history of cultural psychology; mind as a mediated cultural construct; activity theory; the genetic method; internalization and appropriation; the zone of proximal development; inner and private speech (including

gesture); collaborative learning, prolepsis, and scaffolding; the role of artifacts and social relationships in development; interface between sociocultural research and language pedagogy; language testing from a sociocultural perspective; regulation in a first and other languages; metacognition in a first and other languages; identity in a first and other languages; the relationship of sociocultural theory to other theories of second language acquisition. The course has two primary objectives: to provide students with a solid foundational and critical understanding of the principles of sociocultural theory and for them to carry out a research project on second language learning using the genetic method and sociocultural theory principles to interpret data. Given that second language acquisition has become a dominant paradigm within applied linguistics, developmental psychology, and educational psychology, the course is particularly relevant for students not only in the graduate program in Linguistics and Applied Language Studies (LALS), but also to those working in psychology and education, as well as those pursuing the applied linguistics concentration in the language departments. It also serves as a complement to the other courses in applied linguistics offered by LALS in that it exposes students to a very theoretical perspective from what is often encountered in graduate courses in applied linguistics. As such, it challenges them to think in different ways about mind, learning, development, teaching, and assessment. The requirements for the course are: completion of required readings; in-class presentation of one research study selected from the L2 literature; submission of two brief (4-5 pages maximum) critical analyses of two research studies drawn from the relevant research literature; completion of a significant research project (topic to be negotiated with the professor). Course to be offered every other year beginning 2003-04. Maximum enrollment 12.

APLNG 585: Pragmatics in Language Learning and Teaching

3 Credits

Survey of literature on teaching and learning of second language pragmatics.

APLNG 586: Analyzing Classroom Discourse

3 Credits

A theoretical and practical introduction to concepts and methods associated with the analysis of classroom discourse.

APLNG 587: Theory & Research in L2 Teacher Education

3 Credits

Examines the historical and contemporary landscape of theory and research in second language teacher education.

APLNG 588: Design and Research of Technology-Mediated Language Learning

3 Credits

Using computer and multimedia technologies to support materials development and second language acquisition research.

APLNG 589: Technology in Foreign Language Education: An Overview

3 Credits

Approaches to the uses and research applications of multimedia and other educational technologies applied to the teaching of foreign languages. (also crosslisted with SPAN 589)

Cross-listed with: CMLIT 589, FR 589, GER 589, SPAN 589

APLNG 591: Seminar in Second Language Acquisition

3 Credits

Seminar in second language acquisition by second/foreign language learners and implications for language pedagogy and assessment. APLNG 591 APLNG 591 Seminar in Second-Language Acquisition (3) This course focuses on the foundational research and theories of second language acquisition. Course content covers the theoretical underpinnings of models and research on the acquisition of second languages and communicative competence with direct implications for language pedagogy and assessment. Faculty: Sandra Savignon

APLNG 592: Qualitative Research in Applied Linguistics

3 Credits

This course offers an introduction to qualitative research methods in applied linguistics. APLNG 592 APLNG 592 Introduction to Qualitative Research in Applied Linguistics (3) This course is designed to acquaint students with the background, methods, and current status of qualitative research in the field of applied linguistics. The main goals of the course are: 1) to familiarize students with a range of contemporary qualitative approaches to second language research; 2) to develop students' ability to select appropriate methods for particular research questions, 3) to develop critical awareness of issues related to validity and ethics in research design and writing; 4) to enhance students' skill in the collection and analysis of qualitative data. The class will review a range of approaches to qualitative research (e.g., ethnography, conversation analysis, diary study, case study) as well as issues of ethics and quality in research design, implementation and presentation. Students will be evaluated on reading and discussion (20%), assignments (30%), book and article reviews (20%), and final project (30%). APLNG 592 is a required course for the Ph.D. in Applied Linguistics, one of two courses on research methods contributing to the core curriculum. In addition, this course will be beneficial to students in Applied Linguistics options in the foreign languages (French, Spanish, and German).

APLNG 593: Experimental Research on Language

3 Credits

Standard methodologies for planning, conducting, interpreting, and reporting research in Applied Linguistics. APLNG 593 Research Design and Methodology in Applied Linguistics (3) This course introduces standard methodologies for planning, conducting, interpreting, and reporting research in Applied Linguistics. Course activities will include reading texts and articles, completing assigned exercises, participating in group discussions, criticizing research articles, and conducting formal research projects. Students are encouraged, but not required, to focus the research project around their individual thesis or dissertation research and/or to target the research project for publication in a professional journal. The course is aimed at promoting the skills necessary to being effective consumers and producers of research. This will involve learning to formulate research questions, to select appropriate research designs, to appropriate statistical analyses by computer and/or calculator, and to interpret and report the results of studies.

APLNG 595: Internship

1-18 Credits/Maximum of 18

Supervised off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

Prerequisite: prior approval of proposed assignment by instructor

APLNG 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

APLNG 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

APLNG 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

APLNG 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

APLNG 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Students experience in teaching and orientation to other selected aspects of the profession at The Pennsylvania State University.

APLNG 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

APLNG 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

APLNG 802: Focus on English: Teaching Form, Meaning and Use

3 Credits

Develops an understanding of the various domains of the English language as relevant for adult English language learning and teaching. APLNG 802 Focus on English: Teaching Form, Meaning, and Use (3) This course explores various domains of the English language (phonological, lexical, grammatical, pragmatics) in relation to adult English language learning and teaching. Attention is paid to the various components (form, meaning, and function) of these domains and how each component works within larger stretches of discourse. Students will come to understand: language as communication, meaning-making, social practice; grammar as both structure, arrangement, rules and choices; and

language teaching concerned with both language form and language use. The major topics covered include the sound system, lexicon, grammar, tense & aspect, modality, spoken & written texts, discourse & genre, and pragmatics. Students will engage in a variety of data analysis activities that assess their knowledge of the various domains of language and engage in practical activities that require them to apply these understandings to adult English language teaching. This course is one of four required courses that make up the Post-Baccalaureate Credit Certificate in Teaching English to Speakers of Other Languages (TESOL).

APLNG 804: Focus on Learners: Identity, Community and Language Learning

3 Credits

Explores how individual identities shaped by cultural differences, social positioning, institutional roles and structures influence English language learning and teaching. This course explores how individual identities shaped by cultural differences, social positioning, and institutional roles and structures influence the learning and teaching of English in an increasingly globalized world. This course will enable students to: a) recognize the multiple dimensions of one's cultural, linguistic, and educational backgrounds, b) understand the roles and values associated with varieties of English, c) become sensitive to the complex social, cultural, political, and institutional factors that affect adult English language teaching and learners' language learning in diverse instructional settings, d) create culturally responsive curricula that is appropriate for adult English language learning communities in diverse instructional settings. The major topics covered include: developing an understanding of language identities; recognizing diverse instructional settings as cultural contexts of learning; and applying these understandings to adult English language teaching. Students will engage in a variety of practical activities in which they reflect on their own language learning and cultural experiences, conduct an exploration of a bi/multilingual/cultural community and its related instructional settings, and write a final reflective paper that examines learners' identity, community and English language learning in diverse instructional settings. This course is one of four required courses in the Post-Baccalaureate Credit Certificate in Teaching English to Speakers of Other Languages (TESOL).

APLNG 806: Focus on Classrooms: Planning and Supporting Language Learning

3 Credits

Develops a critical awareness of one's teaching practice and highlights instructional planning and classroom interactions with adult English language learners. This course will guide candidates to analyze the interactional patterns and discourse of diverse instructional settings and the factors that impinge upon planning and supporting effective instruction for adult English language learners. Students will: a) examine their own beliefs and knowledge about language learning and language teaching and become aware of the impact of such knowledge and beliefs on instructional practices; b) recognize the highly situated nature of teachers' instructional decisions and practices and develop an awareness of instructional language & classroom discourse that supports English language development; c) devise, select, and/or adapt a wide range of curricular resources to meet the linguistic, social, cultural and educational needs and goals of English language learners; d) develop lesson plans, evaluate curricular units and write teaching objectives; e) connect instruction to local and global activities and problem-solving using the imagination, collaboration, computer and other technological resources. Students will observe several English language instructional

settings, recognize instructional models and classroom interactional patterns, review and adapt textbooks, and develop their own materials using authentic language texts. A focus will be on writing clear teaching objectives and lesson plans and the use of new technologies to support adult English language learning. This course is one of four required courses in the Post-Baccalaureate Credit Certificate in Teaching English to Speakers of Other Languages (TESOL).

APLNG 808: Focus on Instruction: Teaching and Assessing Language Learning

3 Credits

Develops an understanding of and ability to use effective teaching and assessment practices that support adult English language learning. This course facilitates the candidate's understanding of and ability to use effective teaching and assessment practices that support adult English language learning. Students will: a) recognize the highly situated and interpretative processes involved in English language learning and teaching and be able to reflect on, critically analyze, and evaluate their own instructional practices; b) understand subject matter content from an instructional perspective, learn to anticipate areas that may require additional instructional support, and carry out a range of appropriate instructional strategies and activities that support English language development; c) demonstrate an understanding of the central issues and current approaches to the teaching of English language speaking, listening, reading, writing, grammar, as well as approaches to language instruction that are content-based and focused on English for specific purposes; d) recognize the interconnectedness of teaching and assessment, assess students' knowledge using multiple forms of assessment, and address students' diverse needs, backgrounds, and English proficiency as they plan instruction. Major topics will include concepts surrounding second language assessment as well as classroom strategies to evaluate and monitor adult learners' English language learning. Also, students will explore the central issues and techniques for teaching oral communication (listening and speaking), literacy (reading and writing), and grammar. Students will complete a curricular development project, teach and videotape classroom lessons for mentor instructor feedback. A focus will be on guiding students to develop their own teaching practices appropriate to a group of adult English language learners in the specific context in which they live and work. This course is one of four required courses that make up the Post-Baccalaureate Credit Certificate in Teaching English to Speakers of Other Languages (TESOL).

Architectural Engineering (AE)

AE 530: Computer Modeling of Building Structures

3 Credits

Theory and application of structural analysis using the direct stiffness method. Modeling assumptions, validation, interpretation of computer output. A E 530 Computer Modeling of Building Structures (3) This course addresses the theory and application of structural analysis using the direct stiffness method with matrix formulation, applying computer programs to the analysis of two- and three-dimensional structures. Topics include validation and interpretation of results from computer analyses, as well as practical analysis techniques and the design of building structures to satisfy building code requirements. The course is designed to provide students with the ability to create computer models representative of actual building response and in line with prevalent modeling techniques implemented using commercial structural analysis

software. Primary objectives include developing an understanding of the process used by computers to solve structural systems, with emphasis on the use of computer models in the analysis and design process to satisfy building code requirements. This is a mandatory course for students in the structural option within the integrated undergraduate-graduate degree program in architectural engineering (B AE/M AE), and it is a valuable course for all structural engineering graduate students. Students must have completed an undergraduate course in structural analysis of determinate and indeterminate systems. Since some homework problems require proportioning structural members to resist combined loading conditions, the course prerequisites include introductory courses on the design of steel and concrete members. Also required is the knowledge of elementary matrix algebra and exposure to advanced programming of electronic spreadsheets. This course involves significant instruction in the AE Department computer laboratory, which is equipped with several commercial structural analysis software programs capable of handling large structural models.

Prerequisite: A E 401 , A E 402 and A E 430

AE 531: Legal Aspects of Engineering and Construction

3 Credits

Basic legal doctrines, contractual relationships between parties, analysis of construction contract clauses, contract performance, and professional practice problems.

Prerequisite: C E 431W

Cross-listed with: CE 531

AE 532: Post-Tensioned Concrete Building Design

3 Credits

This class will explore a set of structural solutions that are often selected when buildings need long spans and/or thinner structural solutions, including efficient transfer members. Students will develop an ability to analyze and design pre-stressed concrete with a specific focus on Post-Tensioned (PT) applications to buildings. PT Design will specifically be applied to building solutions as applicable to ACI 318 and PTI Standards. Content will interweave a focus on the analysis and design of one- and two-way PT slabs systems, beams and girder systems, while also covering lateral systems and the repair and rehabilitation of aging PT projects. Discussions on new innovative PT research ventures will be included. The goal of this class is threefold: 1) take on the role of a designer and create structural solutions in PT, 2) apply fundamental knowledge of pre-stressed concrete to evaluate serviceability and strength to see if members that were designed have sufficient capacity, and 3) learn commercially available software to design gravity systems at a larger content than isolated slabs.

Prerequisite: AE 430; Concurrent: AE 431

AE 534: Analysis and Design of Steel Connections

3 Credits

Connection analysis and design for steel buildings with an emphasis on the AISC Specification. A E 534 A E 534 Analysis and Design of Steel Connections (3) This course covers the theory of steel connection analysis and design including member, bolt and weld limit states as described in the AISC Specification and the Manual of Steel Construction . With sound knowledge in the basics of steel connection limit states, specific shear, moment and bracing connections are studied in detail.

Along with the fundamental theory applied to each connection type, use of the applicable design aids contained in the Manual of Steel Construction is covered. This course is expected to be particularly useful for students entering the structural design profession upon graduation or those engaging in steel connection research. This course is required of students enrolled in the MAE Structural Option in the Architectural Engineering Department. Additionally, this course is commonly taken by structural engineering graduate students in both the Architectural Engineering and Civil and Environmental Engineering Departments. Student evaluations are based on their performance on a mid-semester exam, a final exam, out of class assignments, projects, and presentations. This course will generally be offered each fall, with an anticipated enrollment of 25-35 students.

Prerequisite: A E 401 and A E 430

AE 535: Historical Structural Design Methods

3 Credits/Maximum of 999

Qualitative, graphical, and quantitative methods of structural design as practiced from ancient Rome through the nineteenth century. This course will explore, qualitatively and quantitatively, methods of structural analysis and design used from 100 BC through the end of the nineteenth century, with an emphasis on nineteenth century design methods. The course will increase students' appreciation for the effectiveness of obsolete structural analysis and design methods. Participation in the course will prepare students for successful preservation of historic structures by introducing the process by which these structures were conceived and designed.

AE 537: Building Performance Failures and Forensic Techniques

3 Credits

This course provides a background in identification, evaluation, and analysis of a broad set of architectural and structural performance failures.

Prerequisite: A E 401 , A E 402 , A E 430

AE 538: Earthquake Resistant Design of Buildings

3 Credits

Introductory engineering seismology, basic principles of structural dynamics, application of earthquake design provisions of model building codes to design of buildings. A E (C E) 538 Earthquake Resistant Design of Buildings (3) The main objective of this course is to familiarize students with basic principles of design of buildings to resist earthquake effects. Since building design is governed by the Building Code, currently, International Building Code that adopts American Society of Civil Engineers (ASCE) document ASCE-7 for load determination, the seismic provisions of ASCE-7 will be used as the basis for design. The course starts by introducing earthquake phenomenon and engineering seismology concepts. The basic principles of structural dynamics are then covered for single degree of freedom systems starting from free vibration to random loading so that students learn how a ground acceleration time-history subjected to the base of a building can be converted to a time varying effective seismic load on the mass. After introduction of response spectrum, introductory material on multi-degree of freedom systems is introduced so that students can determine natural frequencies and mode shapes for multi-story buildings and perform modal superposition analysis to determine displacement and force responses. Next, the principles of earthquake resisting design related to

energy dissipation, ductility, over-strength, and redundancy followed by seismic provision of the building code are discussed. The main design principles related to the two main materials for building construction consisting of reinforced concrete and structural steel are next discussed. The focus will be to illustrate how lateral load resisting systems such as shear walls, moment resisting frames, or braced frames made with such materials as appropriate are designed to resist earthquake effects based on respective material code provisions, that is, American Concrete Institute (ACI) for concrete and American Institute of Steel Construction (AISC) for steel. The last part of the course will introduce seismic retrofit, base isolation systems and the concept of performance based design.

Prerequisite: A E 401 , A E 402 , A E 430

Cross-listed with: CE 538

AE 540: Computational Design & Optimization for Buildings

3 Credits

This course focuses on emerging computational approaches for creative multi-factor parametric research, early-stage design and optimization of buildings. It begins with an overview of the principles of parametric design and visual programming before covering strategies for design space exploration and optimization in depth. Topics include computational design fundamentals such as problem parameterization and formulation; heuristic, gradient-based, and interactive optimization; multi-objective optimization; surrogate modeling; and data visualization for decision-making. Beyond traditional optimization, it highlights ways in which elements of a building design optimization problem (variables, the geometric definition, constraints, objectives) can be interactively interpreted, manipulated, and connected, often using data science techniques, to provide effective feedback and guidance during building-related research and design, which can include both qualitative and quantitative goals. Although the theory of these subjects is described, the emphasis is on how they can be used in research to improve the design and construction process.

Recommended Preparations: Basic understanding of calculus, linear algebra, at least one major building engineering subdiscipline (structural, mechanical, lighting/electrical, acoustics, construction), and programming concepts.

AE 542: Building Enclosure Science and Design

3 Credits

The building enclosure: nature, importance, loadings; building science: control of heat, moisture, air, hygrothermal analysis; design: walls, windows, roofs, joints. A E 542 A E (C E) 542 Building Enclosure Science and Design (3) The building enclosure, or envelope, is the environmental separator in any building and is, like the superstructure and the service systems, one of the major physical components of the building. The primary objective of this course is to develop an understanding of the nature, importance, functions, and performance of the building envelope in general. The necessary building science—concerning primarily heat, moisture, and air—is covered, and hygrothermal analysis procedures are developed. A generalized categorization system for enclosure elements, i.e., walls (both above- and below-grade), roofs, and other enclosure sub-assemblies is proposed. General design strategies are developed. The design of specific wall systems (both above- and below-grade), roof systems, base floors, windows, and their joints is then addressed in some detail. The integration of structures (composite action, restraints, etc.), service systems (especially energy consumption), and finish (exterior and interior) is considered in sonic detail. Evaluation is based on an

equal combination of assignments (6) and examinations (2). This course complements courses in architecture, civil engineering, architectural engineering, and mechanical engineering.

Cross-listed with: CE 542

AE 543: Research Methods in Architectural Engineering

3 Credits

Research skills, critical thinking, academic writing, presentations, use of electronic media, and experimental design applied to AE research topics. A E 543 Research Methods in Architectural Engineering (3) This is a course intended primarily for graduate students in Architectural Engineering. Other students interested in Architectural Engineering research may also take the course. The main objective of the course is to build research skills for students pursuing an M.S. or Ph.D. degree in Architectural Engineering. The research skills to be targeted are critical thinking, academic writing, presentation, oral communication, and use of electronic media, based on materials from architectural engineering projects and literature. These skills will be developed through a series of lectures and exercises to include architectural engineering research topics, such as novel building physical characteristics and occupant performance/environmental perceptions. Lectures in academic writing will cover proposal, report, paper, and thesis writing requirements for Architectural Engineering students. Students will write several assigned essays and term project to gain experience in different academic writing forms as well as architectural engineering research topics. Students are encouraged to use their actual research for the semester project. Based on the project content, each student will then be required to develop an in-class presentation. This part of the course will cover presentation preparation and the critical thinking that is embedded into oral communication skills. The electronic media portion of the course will cover topics such as electronic databases relevant to architectural engineering research topics, search engines, publishing, use of web materials, ethics, and legal considerations. All of the assignments are designed to develop critical thinking through instructor and peer feedback. In addition to the three major targeted areas of research skills development, this course will begin and end with a focus on architectural engineering research topics. The introductory part of the course covers the topics and methods for the four focus areas within the Architectural Engineering program, while the closing portion emphasizes interdisciplinary research efforts and encourages students to thinking in that direction. For example, while experimental design is directly applicable to each individual focus area, the specific instrumentation is area (focus) dependent. Nevertheless, knowledge of different specific data collection methodologies from multiple Architectural Engineering options can enhance the understanding of integrated architectural engineering research topics. Overall, the communication established in all of the course assignments can be used to help develop new architectural engineering research ideas and polish existing ones, which will be helpful to students who are taking the course during their first or second semester in residence.

AE 546: Analysis & Design of Interdependent Building Systems through Data Analytics

3 Credits

A building is an interdependent system of systems, which consists of tens of thousands of building components that spatially or functionally depend on each other. These interdependencies increase the complexity of analysis, research, design, and construction of buildings, and require a high level of multi-disciplinary coordination. This course utilizes Building

Information Modeling (BIM) as an integration platform and central database to coordinate the interdependencies between various building functionalities and support multi-disciplinary coordination. The course begins with an overview of BIM in the construction project lifecycle and addresses operational details of BIM tools for modeling, scheduling, and 4D simulation. Lecture content covers graph theory as a data analytics tool, and the use of graph databases to analyze the information embedded in BIM models for the analysis of system interdependencies. Graph algorithms will be applied to support system optimization. The latest research on BIM and graph analysis will be reviewed and discussed with a focus on the interdependency of building systems. Based on the latest research studies, students complete a semester-long group project that focuses on analyzing building information from a graph perspective for holistically improving building systems or construction activities.

Recommended Preparation: Enrollees should have a working knowledge of Building Information Modeling tools.

AE 549: Data Science in Architectural Engineering

3 Credits

This course aims to equip building science researchers and engineers with the tools for efficiently and effectively transforming data into knowledge, decision, and action. In particular, the course explores parametric and non-parametric regression methods, unsupervised clustering, classification, decision trees, random forests, and support vector machines. Additional advanced statistical learning methods are incorporated as they emerge and become relevant to the field. The course considers the multiple phases of statistical analysis, including data cleaning and pre-processing, exploratory analysis, model building and testing, data visualization, and reporting. Statistical learning topics are motivated through application and case studies involving thermal/building/renewable energy systems, energy efficiency, indoor air quality, and environmental engineering. This course provides a foundation for graduate researchers to engage in follow-on study of more advanced statistical learning methods, while also providing fundamental and beneficial data analysis skills to industry-bound students.

Prerequisite: STAT 401

AE 551: Combined Heat and Power System Design for Buildings

3 Credits

Thermodynamic and thermo-economic analyses methods for determination of optimal, on-site, total energy systems for commercial buildings. AE 551 Combined Heat and Power System Design for Buildings (3) Building systems consume about 40% of the primary energy resources utilized in the United States each year and are responsible for a proportional fraction of air contaminants (NO, SO, fine particulates, CO) and greenhouse gas, CO₂. A conventional energy supply mix for building (grid electricity, site fossil fuel heating) results in approximately 50% primary fuel energy utilization. Advances in scalable, low emissions, electric power generating devices are leading to incorporating on-site power production into the building design. The "waste heat" general is of such a quality that it can be utilized at the site in heating, hot water, absorption cooling, and dehumidification applications. The simultaneous utilization of a primary fuel to generate both the electrical and thermal components in Building Combined Heat and Power (BCHP) can result in total primary fuel utilization values of 85% or greater, electric power reliability increases and significantly reduced emissions, particularly greenhouse gases. This course examines the underlying thermodynamic principles involved in BCHP, pollutant and greenhouse

emission mechanisms and levels associated with both Separate Heat and Power (SHP) and BCHP designs for a given building site. Economic and regulatory principles that govern the application feasibility of a BCHP design for a given building configuration are examined. At the end of the course, students will have the skills and tools necessary to perform an assessment of the feasibility of a BCHP application to a given building site. Specific combinations of distributed, electric power generation equipment (micro-turbines, fuel cells, diesel engines, wind-power) and thermal "waste" utilization from these generating systems will be discussed and analyzed. Case studies are utilized to illustrate the evaluation processes. Using the SHP design methods and principles (ducted air supply systems, hydronic heating and cooling systems, etc.) covered in AE 454 (Advanced HVAC) and central system methods covered in AE 557 (Centralized Cooling Production and Distribution Systems) or AE 558 (Centralized Heating Production and Distribution Systems) for commercial buildings, students will learn how to achieve and establish the same building performance objectives using Combined Heat and Power (CHP) technologies. Since the use of CHP for various building types requires reducing transients in thermal and electric load profiles, the relationship of the structural characteristics of the building (thermal mass) and the use of combinations of artificial lighting vs. day-lighting to the utilization of CHP is investigated.

Prerequisite: A E 454 ; A E 557 or A E 558

AE 552: Air Quality in Buildings

3 Credits

Indoor air pollutants, their sources and health effects; transport of pollutants; modelling of pollutant concentration in buildings.

Prerequisite: A E 454 , A E 455 , M E 410

AE 553: Building Energy Analysis

3 Credits

Fundamentals of building energy dynamics and the simulation of energy flows in a building; validation of programs; practical applications.

Prerequisite: A E 454 , A E 455 and M E 410

AE 555: Building Automation and Control Systems

3 Credits

Advanced techniques in the theoretical analysis and practical design of the automatic comfort controls used in building thermal systems. A E 555 Building Automation and Control Systems (3) A E 555 complements and expands upon the material covered in the undergraduate HVAC control systems course. The objectives of this course are to provide students with an enhanced capability to design advanced building control systems and to ensure proper operation through the use of comprehensive design and analysis tools and evaluation methods. Particular emphasis will be placed on systems integration, fault detection, diagnosis and correction, optimization and performance monitoring. Reference materials will be drawn from recent technical papers and conference proceedings and cover both model-based predictive control and data-driven modeling and control. Students will develop skills to stimulate building control system performance for a wide range of system designs and to implement advanced control strategies and sequences relevant to modern integrated building systems.

Prerequisite: A E 457

AE 556: Solar Engineering of Thermal Processes

3 Credits

Advanced quantitative methods of predicting transient active and passive solar process performance with an emphasis on building solar applications.

Prerequisite: M E 410

AE 557: Centralized Cooling Production and Distribution Systems

3 Credits

Central cooling plant and distribution components and systems; thermal, hydraulic, and economic modeling for planning and design.

Prerequisite: A E 454 ; or M E 411 , M E 410

AE 558: Centralized Heating Production and Distribution Systems

3 Credits

Description and analysis of central heating plant and distribution components and systems; thermal and economic modeling for planning and design.

Prerequisite: A E 454 ; or M E 411 and M E 410

AE 559: Computational Fluid Dynamics in Building Design

3 Credits

Theory and applications of building environmental modeling with Computational Fluid Dynamics (CFD). A E 559 A E 559 Computational Fluid Dynamics in Building Design (3) This course will be a primary interest to Architectural Engineering graduate students in the Mechanical Systems emphasis. Other students interested in the application of Computational Fluid Dynamics (CFD) to Architectural Engineering may schedule the course if they have satisfied the prerequisites. The main objective of this course is to build the knowledge necessary for successful simulations of building indoor and outdoor environments using CFD. The skills developed in the course build on the knowledge of fluid mechanics and building mechanical systems. The course will also add to the available pool of electives for students in the integrated BAE/MAE program. The first part of the course covers general CFD topics on the solution of Navier-Stokes partial differential equations. Different concepts necessary for the solution of the partial differential equations expressing the conservation laws will be introduced along with a CFD software package. In this phase, the course focus will be on the derivation of different equations and their solutions. Analytical solutions will be derived when possible, while most of the problems will require use of numerical solutions. Several homework assignments will require development of small computer programs. The introduced CFD software package will prepare students for the second part of the course that is more applied. The use of CFD in building design is different from its use for other engineering applications because of the domain size and specific boundary conditions such as diffuser airflow, wind, or solar radiation. Most of the time, appropriate boundary conditions distinguish successful from unsuccessful applications of CFD. To address the issues of quality control in CFD simulations, the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) recently developed CFD guidelines that the course will follow from the beginning. The actual guidelines will be introduced to fortify everything learned during the course. Evaluation will be based primarily on analytical homework assignments (30%), two projects (30%), a mid-semester quiz

(20%), and a final examination (20%). This course will be offered each Spring, with an anticipated enrollment of 10 students.

Prerequisite: A E 454 , M E 410

AE 561: Science of Light Sources

3 Credits

In-depth scientific principles of light generation in modern electric light sources, and the resultant characteristics that influence their use for buildings.

Prerequisite: A E 461

AE 562: Luminous Flux Transfer

3 Credits

Radiative transfer applied to lighting analysis; methods for computing direct and interreflected illumination; nearfield photometry.

Prerequisite: A E 461 , CMPSC201 or CMPSC202

AE 563: Luminaire Optics

3 Credits

Optical design of reflectors and refractors for lighting systems; manufacturing methods.

Prerequisite: A E 464

AE 564: Color Science

3 Credits

This course provides students with an understanding of the research that led to the development and application of various metrics for the assessment of color appearance, the performance of light sources and the specification of object colors. Students will learn the scientific theory and practical application of color measurement, including the fundamental theories and computational modeling of human color vision. The goal of this course is for the students to apply knowledge of colorimetry and photometry to evaluate light sources and quantify the color appearance and properties of objects. Students will gain a detailed understanding of the fundamental quantities commonly used in illumination engineering (e.g., color temperature, color rendition metrics, etc.), their use, and limitations. The course is grounded in past and current research literature. Students will build on existing theoretical frameworks and methodologies, allowing students to synthesize new knowledge and produce scholarly work in this field.

Recommended Preparations: A basic understanding of human vision, lighting design practice, and the units applied to lighting measurement

AE 565: Daylighting

3 Credits

Design concepts, solar position, sky luminance distribution models, integration of daylighting and electric lighting controls, physical modeling, computer analysis techniques.

Prerequisite: A E 461

AE 566: Windows and Glazing

3 Credits

This course consists of three major sections. It begins with the basics of solar and sky radiation and the theoretical knowledge in the intersectional area between radiometry and photometry related to building windows and glazing materials. Subsequently, based on the necessary understandings of the above fundamentals, students will learn the multipane window analytical method to characterize and design window and glazing optical and thermal behaviors in terms of both radiometric and photometric aspects. In the meanwhile, the effects on building energy, visual, and thermal performance by such characteristics will be analytically explained to students. The last section in this class focuses on the synthesis of theoretical knowledge and analytical methods by discussing and exploring certain emerging research questions in the area, such as optimization, dynamic functions for solar radiation modulation, integration of nano-structured glazing materials, laminates, and films. In this process, certain data modeling techniques and flexible computational tools will be incorporated with the analytical methods learned above to propose, explore, and express solutions and ideas for the emerging research problems in the building window area.

Recommended Preparation: A basic understanding and knowledge background of building lighting and mechanical systems.

AE 569: Research Topics in Illumination Engineering

3 Credits

Seminar on prior and current research in illumination engineering which define current recommendations and design practice.

Prerequisite: or concurrent: A E 461

AE 570: Production Management in Construction

3 Credits

Applications of production management tools to capital facility projects; theory of production systems in construction; development of production control manual. A E 570 A E 570 Production Management in Construction (3) A E 570 explores the use of production management to efficiently manage the delivery processes of capital facility projects. Students will learn about fundamental models of managing project processes and about tools to manage projects as production systems. The procurement, design, and construction processes that are used in capital facility projects are not usually through of in production process terms. Yet, doing so can develop a deeper understanding of the complexities of capital facility projects and enable project production to be efficiently managed. Production management emphasizes managing projects as complex wholes focusing on the relationships between the parties and tasks to optimize total process performance. A E 570 analyzes the latest production thinking and management tools to manage capital facility projects. The learning objectives of this course are for students to: a) recognize that capital facility projects are complex production systems and understand how principles of production relate to construction projects; b) understand the principles and methods of new production management methods like lean construction; c) be able to apply specific production management tools to specific problems identified on projects, especially those encountered on high performance sustainable building projects; and, d) understand how to use the latest production management planning and control tools to

improve the management of capital facilities projects. A E 570 will be offered each spring with an anticipated enrollment of 25 students. This course uses classroom demonstration, case-based materials, in-class game simulation, and computer software to demonstrate key concepts and production tool applications. Assessment is conducted through out-of-class assignments, homework exercises, and a major project requiring appropriate tool to remedy the problem. The final grade for this course will be based on: Construction process analysis assignment - 15% Experiment design assignment - 25% Homework exercises and classroom participation - 25% Major project, including class presentation - 35% Students entering this course are expected to have knowledge of the construction industry, project delivery processes, and construction means and methods.

Prerequisite: A E 475 , A E 476 or C E 432

AE 571: International Construction Management and Planning

3 Credits

Evaluation of international project environments and participants, modeling and planning international projects.

Prerequisite: A E 570

AE 572: Project Development and Delivery Planning

3 Credits

Methods employed by owners and developers to initiate capital facility projects; defining project objectives, constraints, participants, financing, and delivery methods. A E 572 A E 572 Project Development and Delivery Planning (3) The course explores the methods used by capital facility owners and developers to initiate a project. Many vital decisions are made and critical activities performed early in a project that have major bearing on how the project is completed. These include defining the project objectives, identifying constraints, recognizing stakeholders, and selecting financing and delivery methods. The course explores the latest project development and delivery techniques used to support these decisions. Students will learn how early development activities shape a project, and how building industry professionals are helping to support these activities. Students will develop knowledge and perspective to help their decision-making skills. As the course title implies, special focus will be on high performance delivery planning. The learning objectives of the course are for students to: 1) Understand what occurs in the early stages of project formation as capital facility owners and developers initiate a project; 2) Understand the methods owners and developers use to progress through the capital facility process; 3) Understand the different types of acquisition strategies, project delivery methods, and contractual systems to achieving capital facility owner objectives; and, 4) Understand the decision-making needs of high performance sustainable building projects. Offered in the Fall semester, the course uses case-based materials, hands-on computer simulation, and other classroom demonstration. Case study projects assigned by the instructor, individual homework exercises, and a group project requiring students to apply development techniques to a current downtown State College capital facility development site from the assessment for the course. Students entering this course are expected to know how the construction industry operates, including project delivery methods, engineering economics, preconstruction, and construction means and methods.

Prerequisite: A E 475 , A E 476 or C E 432

AE 573: Construction Automation and Robotics

3 Credits

The goal of this course is to provide an understanding of the challenges confronting automation and robotics in the construction domain, and the current state of such technologies; an advanced understanding of automation and robotics, and the fundamentals needed to begin computer programming for construction automation and robotics. The student will gain hands-on experience in several aspects of construction automation and robotics, including but not limited to: application of wearable sensors for construction safety and health monitoring, use of immersive technology for training, and application of mobile robots for mapping and hazard detection at construction sites. This course is of value to both future construction industry professionals and researchers in the areas of construction safety, robotics, and training.

Recommended Preparations: Basic understanding of machine learning, programming and MATLAB

AE 575: Virtual Facility Prototyping

3 Credits

AE 575 is designed for students who wish to gain a more thorough understanding of the application of virtual facility prototypes in the construction industry. This course examines how building information modeling, advanced visualization, and virtual and augmented reality technology can be used to improve decision-making on construction projects. It builds upon a fundamental understanding of physical design and construction planning information in virtual models of building projects. Topics include virtual prototyping research and applications, design methodologies for interactive virtual prototypes, building design, construction, and operation visualization techniques, and virtual and augmented reality applications for the built environment.

AE 576: Building Information Modeling Execution Planning

3 Credits

AE 576 is designed for students who wish to gain a thorough understanding of research and application of Building Information Modeling (BIM) on Architecture/Engineering/Construction (AEC) projects and within AEC organizations. This course explores advanced topics related to the BIM Project Execution Planning Procedure, including research into advanced BIM and information management approaches. Students will learn how to design a BIM approach to maximize value to a project. Additionally, AE 576 examines the organizational strategy, execution and project procurement to leverage BIM implementation. Students will research planning approaches for organizations to develop their BIM strategy through assessing organizational maturity, aligning BIM vision and objectives to organization's mission and goals, and develop organizational roadmaps to integrate BIM within an organization. The course delves into planning detailed BIM implementation within the operations of an organization through establishing organizational goals and BIM objectives; identifying BIM uses; designing processes; and determining information, infrastructure, and personnel needs. Students should have a general understanding of the AEC industry as a prerequisite to taking this course.

Recommended Preparations: General understanding of the Architecture/Engineering/Construction (AEC) industry.

AE 579: Sustainable Building Project Leadership

3 Credits/Maximum of 999

Examines leadership skill sets, team competencies, and strategic methods for leading sustainable building construction projects and retrofits. AE 579 is focused on the cultivation of leadership competencies that enable the evolution of sustainable methods for design, construction, and operation of buildings. It is intended for students with backgrounds in design, construction, engineering, building operations, and facilities management. AE 579 focuses on the processes and analysis techniques required to lead sustainable projects. The course is intended to support the career advancement of building design and construction professionals, developers, operators, and energy managers. An emphasis is placed on the integrative processes required to design healthy and productive buildings and that promote regenerative effects on site, energy, materials, water, occupant health, and society. The goal of the course is to cultivate leadership and integration skills needed to spearhead the design, construction, commissioning, and operation of sustainable buildings. Course topics include the business case for high performance buildings; guiding metrics and frameworks, analysis tools; integrative team competency requirements, design and delivery methods, and recent research topics that have advanced the practices of high performance building delivery. The course is intended to build upon specialized programs of study in architectural engineering, architecture, and facilities management, and to provide students with an interdisciplinary and integrative perspective of building delivery.

AE 596: Individual Studies

1-9 Credits/Maximum of 9

CREATIVE PROJECTS, INCLUDING NONTHESIS RESEARCH, WHICH ARE SUPERVISED ON AN INDIVIDUAL BASIS AND WHICH FALL OUTSIDE THE SCOPE OF FORMAL COURSES.

AE 597: Special Topics

1-9 Credits/Maximum of 9

FORMAL COURSES GIVEN ON A TOPICAL OR SPECIAL INTEREST SUBJECT WHICH MAY BE OFFERED INFREQUENTLY; SEVERAL DIFFERENT TOPICS MAY BE TAUGHT IN ONE YEAR OR SEMESTER.

AE 598: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

AE 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

AE 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

AE 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Supervised experience in teaching and orientation to other selected aspects of the professional at the Pennsylvania State University.

AE 603: Foreign Academic Experience

1-12 Credits/Maximum of 999

Foreign study and/or research constituting progress toward the degree at a foreign university.

AE 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

AE 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

AE 862: Distributed Energy Planning and Management

3 Credits

Theories and practices of distributed energy production and management in the context of regional and integrated energy grid structures.

AE 868: Commercial Solar Electric Systems

3 Credits

Theories and practices of solar electric systems including component selection, performance simulation, grid interconnection, codes, and design documentation.

AE 878: Solar Project Development and Finance

3 Credits

Economic analysis of solar energy projects, project development process, energy policies, finance methods, and economic analysis tools.

AE 882: MAE Capstone Design Project

3 Credits

This course serves as the capstone project course for the Integrated (IUG) Master of Architectural Engineering degree. Students conduct independent investigations into the design and analysis of building systems and/or construction processes for an actual building project, with an emphasis on systems integration, sustainability, and performance. Each student proposes the scope of work they will address on their building project, which must include topics from one or more of a student's MAE graduate-level courses and be approved by the course instructor. Students may also investigate topic areas that lie beyond those covered in formal coursework. Students perform research into engineered building system options and construction processes that meet established project criteria, conduct technical analyses, finalize their recommendations, prepare a written report on their work, and deliver a final project presentation. Meetings with the instructor/project adviser(s) are scheduled throughout the semester to review progress and provide feedback on the student's work. While most student projects

are conducted independently, students may also work as part of a multi-disciplinary team (consisting of students from different undergraduate option areas) where integration across subject areas is a major design consideration in addition to the focused work in the student's AE option area.

Prerequisite: AE 481W **Corequisite:** AE 483**AE 897: Special Topics**

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

Architecture (ARCH)

ARCH 501: Analysis of Architectural Precedents: Ancient Industrial Revolution

3 Credits

Analysis of architectural precedents from antiquity to the turn of the twentieth century through methodologies emphasizing research and critical inquiry. The 20th century Italian architectural historian and theorist Manfredo Tafuri argued that architecture was intrinsically forward-looking and utopian: "project" in both the sense of "a design project" and a leap into the future, like "projectile" or "projection." However, he also argued that architectural history, understood deeply and critically, is indispensable if that leap is to make the world a better place. For any new building to make a positive and meaningful contribution to the physical and human world, architects must not only know what they can build, but what has been built, and what architecture's positive and negative impact has been in the past. This course will introduce the history of architecture from antiquity to the turn of the 20th century through (1) ten selected buildings, one covered each week, and (2) a methodology emphasizing research and critical inquiry. Borrowing from the "problem-based learning" approach that is central to studio education, this class will present "question-driven history." Students will learn how to find, use, and critique architectural history resources by attempting to answer six fundamental questions for each of the studied buildings.

Concurrent: ARCH 531**ARCH 502: Analysis of Architectural Precedents: Modernism**

3 Credits

Analysis of architectural precedents of modernism from its multiple, disputed points of origin through the late twentieth century. What is "modern" architecture? What conditions gave rise to the various movements that have come to dominate design since the industrial revolution? What sort of design did these theoretical works and movements produce, and how did it contribute to architecture's development? An understanding of modernism and its legacy is crucial to a thorough understanding of the architectural culture of the 21st century. By examining buildings from early modernism to today, this course will introduce the theory of modern architecture from its multiple, disputed points of origin through the late twentieth century. Our operative term will be modernisms, in the plural. "Modernism" is a convenient and important label, but its suggestion of unity can camouflage the complexity of a phenomenon that spans decades, cultures, continents, and ideas.

Prerequisite: ARCH 501; Concurrent: ARCH 532

ARCH 503: Materials and Building Construction I

3 Credits

Examination of fundamental and advanced building materials, systems and construction technologies associated with their architectural use.

Concurrent: ARCH 531, A E 421

ARCH 504: Materials and Building Construction II

3 Credits

Continuing examination of fundamentals and advanced building materials, systems and construction technologies associated with their architectural use. ARCH 504 Materials and Building Construction II (3) This first-year graduate seminar course will continue to present students with information on fundamental and advanced building materials and systems and on construction technologies associated with their architectural use. Students will also consider the advancements in architectural materials and technologies. It is the second part of a two-semester sequence preceded by ARCH 503. Recurrent course themes include 1) architecture as a product of culture (wisdom, abilities, aspirations), 2) architecture as a product of place (materials, tools, topography, climate), the relationship between architectural appearance presented and the mode of construction employed, 3) materials and making as an expression of an idea and 4) the relationship of a building whole to a detail. This course is motivated by these concerns: a firm belief that architects must know and engage the age they are living in, so as to design and represent it with extreme appropriateness. The course explicitly addresses engagement with society/culture and its appropriate representation by asking students to form opinions about the architectural potential of contemporary and emerging technologies. Their opinions are informed by the presentation of architectural materials and associated construction methods as they evolved - contextualized by human history and by their application in the built environment. In this class students are seeing the material and technological means of making architecture continuously altered by shifting human cultural desires and artistic/scientific/industrial developments. They are simultaneously receiving instruction in their application and use. Through assignments, students also work directly with materials at full scale and learn to represent construction systems through the conventions of drawing and modeling.

Prerequisite: ARCH 503; Concurrent: ARCH 532, A E 422

ARCH 510: Contemporary Architecture and Planning Theories

3 Credits

Examination of core architectural and urban theories through a critical analysis of key concepts from antiquity to the present.

Prerequisite: ARCH 502; Concurrent: ARCH 533

ARCH 511: Theoretical Perspectives in Architecture

3 Credits

The impact of rationalism and romanticism on contemporary developments and theoretical postures in architectural design.

ARCH 512: Critical Theory in Architecture

6 Credits

Inquiry into paradigms of critical theory in architecture theory, practice, and teaching. Evaluation of central texts, methods, theories, and outcomes. ARCH 512 Critical Theory in Architecture (6) ARCH 512 is composed of six chronologically arranged units of study that examine the major developments in the evolution of discursive practices that ground architecture theory, teaching, and practice. Modern and post-Modern critical theories in architecture have borrowed from a number of tangent disciplines, such as Phenomenology, Positivism, Existentialism, Narratology, Structuralism, Deconstruction, Grounded Theory (social sciences), Cognitive-Behaviorism, Neo-Kantianism, Psychoanalysis, Reception Theory, etc. Historical methodology, Archaeology, Anthropology Art History, and other disciplines have also had their impact. As a result, critical theory in architecture typically lacks uniform methodologies and stable definitions. In recent years, many disciplines have undergone attempts to consolidate discourse around the influence of language and culture within the historical context of evolving world ideologies and their effect on communication, material culture, and the physical environment. Architecture has responded to this general trend in a number of ways that invite cross-disciplinary comparisons and methodological adaptations. The course will take advantage of featuring visiting scholars whose expertise in diverse areas of study will provide participants with direct contact with the widest possible range of theoretical perspectives. The strategy of the course will be a comparison and critical evaluation of what appear to be the most effective research methods within the pressing concerns of environment, population growth, material resource depletion, and international conflict. The aim will be to establish relevance as well as research competence and effective expression.

Prerequisite: admission into Ph.D. Program in Architecture or permission of instructor

ARCH 512A: Doctoral Research Theory

3 Credits

Inquiry into paradigms of theory in architecture and landscape architecture, as pertain to doctoral level research, practice, and teaching.

ARCH 512B: Doctoral Research Design

3 Credits

Research design and methods, sampling strategies, potential biases, confounding problems, and the limits of inference in architecture and landscape architecture research.

Prerequisite: ARCH 512A

ARCH 519: Research in Architecture and Urban Design

3 Credits

This course prepares M. Arch. students to conduct research leading to their design project by looking at foundational methods in the field. It also trains students to identify significant project topics and engage in individual critical research in order to build the intellectual and scholarly armature sustaining the future design that every student will undertake. The target is to raise critical awareness of the social, cultural, economic, and disciplinary complexities in the context of different spatial practices. The course will engage research in architecture in order to find opportunities to make significant claims contributing to the advancement

of the field. The course will explore different methodologies, whether based in the humanities or the sciences, in order to inform research paradigms in the discipline of architecture in academic institutions. In addition, the course will explore the specifics of formal speculation as a form of knowledge, as well as the relationship between the discipline and its formal, cultural, and economic past, present, and future.

Prerequisite: ARCH 534

ARCH 520: Methods of Inquiry in Architecture and Urban Design

3 Credits

Introduction to the methods of research and inquiry commonly used in architecture and urban design.

ARCH 521: Visual Communications I

2 Credits

Examination of two and three-dimensional graphic communication and modeling techniques for an advanced understanding of visual communication in architecture.

Concurrent: ARCH 531

ARCH 522: Visual Communications II

2 Credits

Continuing examination of two and three-dimensional graphic communication and modeling techniques for an advanced understanding of visual communications in architecture. ARCH 522 Visual Communications II (2) This course introduces students to a wide range of digital drawing, modeling and output techniques and concepts that are essential for architectural design in order to formulate knowledge and expertise, and investigate their potential in architectural design studio. While providing a theoretical standpoint of contemporary methodologies, knowledge gained in this course will allow students to work rigorously and precisely through conceptual exploration, design development and ultimately meaningful representation of their design intentions. Skills developed in ARCH 521 will provide the foundation for work performed in this course. The course will be conducted in the form of weekly lectures to cover theories and methods, and accompanying weekly working sessions, software and hardware demonstrations with individual instruction in the computer lab. Brief lab assignments will be assigned to ensure proliferation and adoption of course material. The coursework may be coordinated with design studio (ARCH 532) assignments providing the students with the opportunity to master their digital skills in a meaningful manner.

Prerequisite: ARCH 521; **Concurrent:** ARCH 532

ARCH 531: Architectural Design I

6 Credits

Studio studying the core methods of the discipline of architectural design and developing skills related to its expression and communication. This course prepares students to understand fundamental architectural elements and concepts, to develop a sensitivity and awareness required for valid interpretations, and to develop a reflective and critical design process with emphasis on one's individual ability to articulate ideas. The major means of accomplishing this is through the design of simple buildings and environments. The semester is divided into two halves: The first half of the semester focuses on fundamental and abstract principles

of architectural design, and the theory associated with design principles. It covers architectural fundamentals such as drawing and making models through a series of abstract exercises, and introduces the principles and methods used at various stages of design analysis and synthesis processes. The second half of the semester makes a transition from abstract principles to fundamental architectural design principles such as function, scale, and structure to concepts of space and form, as they pertain to small scale design projects. The assigned projects explore and develop conceptual strategies for fundamental formal and spatial design, emphasizing the role of ordering principles and of fundamental architectonic elements in the implementation of design intentions.

Prerequisite: ARCH 530; **Concurrent:** ARCH 503, ARCH 521 , A E 421

ARCH 532: Architecture Design II

6 Credits

Studio focusing on the design of small to medium scale architecture that addresses the complexity of a total work.

Prerequisite: ARCH 503 , ARCH 531 , A E 421; **Concurrent:** ARCH 504, ARCH 522 , A E 422

ARCH 533: Architectural Design III

6 Credits

Studio emphasizing the design of multi-functional buildings, and stress the creative synergy among building design, structure, site, and context.

Prerequisite: ARCH 504 , ARCH 532 , A E 422; **Concurrent:** ARCH 510, A E 211

ARCH 534: Architectural Design IV

6 Credits

Studio developing advanced designs for comprehensive buildings responding to human needs in terms of cultural meaning, context, and technical requirements.

ARCH 536: Design-Inquiry

1-12 Credits/Maximum of 12

Integration of research with the designing of architectural and urban settings.

Prerequisite: ARCH 520 and approval of advisor

ARCH 541: Topics in Theory

3 Credits

A series of presentations on the development of contemporary architectural theory.

Prerequisite: ARCH 511

ARCH 542: Topics in Community and Urban Design

3 Credits

Community and urban design as an area of design inquiry and interdisciplinary practice. ARCH 542 ARCH 542. Topics in Community and Urban Design (3)The intention of this course is to introduce students to the fundamental elements of community and urban design practice

within the fields of architecture, landscape architecture, and planning. An investigation into the diverse traditions of design practice- technical, esthetic, and theoretical – will highlight the role that design plays in the urban and community context and also serve as a powerful medium for analyzing the confluence of the social, economic, political, and ecological dimensions that give form to cities and communities. An objective of the course will be to develop a critical perspective in architectural design vis-a-vis the restructuring of urban and community space. Topics to be covered in the course include: history of the discipline, contemporary urban and community issues, methodologies and techniques in community action research and participatory design, and introduction to the case study method of analysis. It is expected that students will actively participate in class discussions, present a case study of a project related to the topics covered in the class, and submit a research paper on the selected case study. ARCH 542 will be offered as a 3-credit course on an annual basis during the spring semester. Students with graduate standing in architecture and landscape architecture will be given priority for enrollment. However, a limited number of other students may enroll pending consent of the instructor.

Prerequisite: graduate standing or consent of instructor

ARCH 543: Topics in Digital Design

3 Credits

Inquiry into digital design paradigms of architecture and related disciplines; exploration design principles and operations supported in digital/virtual design environments.

Prerequisite: graduate standing or consent of instructor

ARCH 550: Ethics in the Built Environment

3 Credits

Ethics In the Built Environment is an applied theory course that uses negotiation strategies to examine issues broadly relating to the creation and use of the built environment, including research practices and professional ethics. The course examines the role of power imbalances as underlying ethical questions, and discusses means of mediating the resulting ethical problems in a sustainable manner. Through readings, discussions, short exercises, and a term paper, students will gain a greater awareness of ethical issues raised through the production and use of the built environment, and will develop tools to assess ethical issues and identify appropriate resolutions. Topics covered in this course include: defining ethical concepts, tools for evaluating ethical issues in the built environment, understanding built power and the role of empowerment, the power of marketing, accuracy in historical research, urban design and planning and the right to the city, gender and the built environment, architectural practices, the ethics of green architecture, the ethics of design computing, as well as research on individual case studies.

ARCH 591: Architectural Research

2-12 Credits/Maximum of 12

Guided research project.

ARCH 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

ARCH 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

ARCH 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

ARCH 601: Ph.D. Dissertation

0 Credits/Maximum of 999

Ph.D. Dissertation Full-Time

ARCH 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Supervised experience in teaching and orientation to other selected aspects of the profession at The Pennsylvania State University

ARCH 603: Foreign Academic Experience

1-12 Credits/Maximum of 12

Foreign study and/or research constituting progress toward the degree at a foreign university.

ARCH 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

Art (ART)

ART 501: Art Research

2-6 Credits/Maximum of 6

Original study and practice in art relating to material, concept, or technique.

ART 505: Graduate Seminar

2 Credits/Maximum of 8

Seminar covering special topics at the graduate level, emphasizing interdisciplinary discourse including criticism and review of graduate work.

ART 511: Issues in Contemporary Art

1-3 Credits/Maximum of 6

A critical survey of issues in contemporary art.

ART 515: New Media Art I

1-7 Credits/Maximum of 14

Individual problems in new media arts practice leading to development of a body of work representative of the artist.

ART 516: New Media Art II

1-7 Credits/Maximum of 14

Individual problems in new media arts practice leading to development of a body of work representative of the artist.

Prerequisite: ART 515

ART 530: Sculpture I

1-7 Credits/Maximum of 14

Individual problems in sculpture leading to the development of a collection or body of work representative of the artist.

ART 531: Sculpture II

1-7 Credits/Maximum of 14

Individual problems in sculpture leading to the resolution of a collection or body of work representative of the artist.

Prerequisite: ART 530

ART 545: Printmaking I

1-7 Credits/Maximum of 14

Individual problems in printmaking leading to the development of a collection or body of work representative of the artist.

ART 546: Printmaking II

1-7 Credits/Maximum of 14

Individual problems in printmaking leading to the resolution of a collection or body of work representative of the artist.

Prerequisite: ART 545

ART 550: Painting I

1-7 Credits/Maximum of 14

Individual problems in painting leading to the development of a collection or body of work representative of the artist.

ART 551: Painting II

1-7 Credits/Maximum of 14

Individual problems in painting leading to the resolution of a collection or body of work representative of the artist.

Prerequisite: ART 550

ART 570: Graphic Design I

1-7 Credits/Maximum of 14

Individual projects in design with special emphasis on specialized topics of graphic design.

ART 571: Graphic Design II

1-7 Credits/Maximum of 14

Individual problems in design, with special emphasis on professional practice in the area of graphic design.

Prerequisite: ART 570

ART 580: Ceramics I

1-7 Credits/Maximum of 14

Individual problems in ceramics leading to the development of a collection or body of work representative of the artist.

ART 581: Ceramics II

1-7 Credits/Maximum of 14

Individual problems in ceramics leading to the resolution of a collection or body of work representative of the artist.

Prerequisite: ART 580

ART 592: Photography I

1-7 Credits/Maximum of 14

Individual problems in photography leading to the development of a body of specialized work representative of the artist.

Prerequisite: 12 credits of PHOTO405

ART 593: Photography II

1-7 Credits/Maximum of 14

Individual problems in photography leading to the resolution of a collection or body of work representative of the artist.

Prerequisite: ART 592

ART 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

ART 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

ART 602: Supervised Experience and College Teaching

1-3 Credits/Maximum of 6

Supervised and graded teaching experience.

Art Education (AED)

AED 502: Research in Art Education

3 Credits

Examination of past and present research in art education, an introduction to general methods of research, and critical evaluation of research in art education.

AED 505: Foundations of Art Education

3 Credits

An examination of classic theories in art education and their relevance to current developments.

AED 513: Summer Institute on Contemporary Art

3 Credits

A blended summer course with on-campus and online components and a focus on intersections among contemporary art, curriculum, and pedagogy. AED 513 Summer Institute on Contemporary Art (3) This course is a summer session offering with a focus on intersections between contemporary art and curriculum. A collaborative effort between the Palmer Museum of Art and the Art Education Program, the course employs an innovative instructional approach that combines an intensive one-week intensive on-campus experience followed by correspondence, discussion, and presentation of final student projects using an online course management system during the ensuing five weeks. The course is designed to appeal to practicing K-12 educators, art educators, art education graduate students, and interested students from other disciplines as a forum in which to strengthen their focus on interdisciplinary curriculum theory and design constructed from collaborative interpretations of contemporary works of art and visual culture. As a critically challenging learning experience, this course will prepare students to thrive in a global environment by providing principles of interpretation as the foundation for encounters with beliefs, issues, and practices informed by and evidenced in contemporary works of art and visual culture. Due to the interdisciplinary interpretations and curriculum projects that will result from meaningful engagement with contemporary works of art, the course will promote interdisciplinary teaching and program development. The innovative format: a one-week intensive experience followed by discussion and presentation of final projects supported by an online course management system; challenges conventional approaches to instruction and presentation of evidence of student learning, thereby responding to and requiring new ways to assess and improve student learning outcomes in and through contemporary visual art.

AED 522: Participatory Visual Inquiry in the Public Sphere

3 Credits

Theory and praxis seminar to consider contemporary practices of participatory inquiry and public action with an emphasis on visual methodologies. AED 522 Participatory Visual Inquiry in the Public Sphere (3) Students will analyze practices of participatory inquiry in response to social and cultural issues, situations, and challenges taken up by visual artists and interdisciplinary collectives who intend their work to construct new knowledge and positive change through collective action. Students will discuss and identify societal situations and propose possible responses as sites for participatory inquiry. A key focus of the

course is the exploration of theories and practices of collaborative inquiry in the public sphere with emphasis on visual methodologies. The course revolves around related and overlapping concepts such as participatory democracy, participatory culture, ideas to actions, collaborative inquiry, collaborative design, community-based research, public pedagogy, and action research. The course is intended to function as a discursive space to broaden perceptions about contemporary art and inquiry practices; informal and public pedagogies; the interdisciplinary roles of art and artists in society, community-based projects and inquiry; and ways collaborative artmaking and cultural production can function as forms of research. Course content focuses on community artworks, interdisciplinary creative projects, and other forms of cultural production created for and existing within the public sphere in response to specific issues, challenges, and conditions. Examples of such work include public murals, public performance interventions, environmental responses, community health and change interventions, and social media activism, among others.

AED 523: Transdisciplinary Creativity: Eco-social Justice Art

3 Credits

Transdisciplinary creativity develops new knowledge, metaphors, visualizations, and insights through performative renderings from dialogue, collaboration, exploration, and experimentation. Transdisciplinary creativity is the coming together of two or more disciplines in order to create something more than the individual or the community by recognizing, combining, and utilizing knowledges of all participants. Moreover, transdisciplinary creativity is a social process that develops sense-abilities. Sense-ability is the capacity to attend to the sensory and sensation, as a collective affective awareness of the environment. Students in the course will explore how different methodologies enhance understanding of complex issues such as sustainability, climate change, climate diaspora, environmental racism, and resource depletion. The national and international scope of environmental conversations is forging alliances across disciplines around urgent matters such as climate change. Rather than STEAM being used as an acronym for Science, Technology, Engineering, Arts, and Mathematics, STEAM is explored, in this course, in terms of collectives such as EcoArtTech, in which their work is eco-social justice action to create STEAM. Moreover, STEAM is considered as transdisciplinary creativity for eco-social justice. From a transdisciplinary view of STEAM, works of art are not an appendage or a singular discourse. STEAM is a transdisciplinary approach to environmental issues. STEAM as an action emphasizes ecology, transdisciplinary research, and creativity as a social process.

AED 524: Arts Education Policy and Advocacy

3 Credits

Critical examination of current and emerging arts education policies in the United States in relation to federal, state, and local education and cultural policies. AED 524 Arts Education Policy and Advocacy (3) Students who are going to become leaders in arts education should understand social and political forces that shape the landscape where they work. Although art educators were identifying policy needs and submitting resolutions with policy recommendations to national agencies during the interwar years, arts education policy gained importance during the 1960s with the founding of The National Endowments for the Humanities and Arts. Arts education "as opposed to art, dance, music, or theatre education" is a political construct forged in order to successfully advocate for inclusion of visual and performing arts in

National Educational Goals during the late twentieth century. In this course, students will explore what counts as policy for arts education and how policy discourse is framed; who constitutes stakeholders and policy makers; contexts where policy is advocated and created; and how advocates develop and communicate proposals for needed policies. Working in small groups, students will examine recent issues related to arts education policy, presenting those issues in class.

AED 525: Including Difference

3 Credits

Disability is normal. Ableness is temporary. However, social stigmas, misunderstandings, and notions of "normal" exclude students and adults with disabilities. How have artists with disabilities offered worldviews that decenter normal? To pursue decentering normal, students in the course explore the creative practice of contemporary artists labeled by society as disabled to understand how their viscerally empowered art can function pedagogically to decenter notions of normal. Decentering notions of normal begins with identifying and challenging social systems that-through visual, lingual, and technological cues-communicate which traits are considered normal and which are not. While the analysis of linguistic and visual representations is instructive for articulating identity construction and its relationship to power and privilege, these lines of inquiry within disability studies overlook the realities of embodied difference that are a part of many people who live with disabilities. Notions of a normalized body frame certain patterns of behavior, cognition, affect, and physicality from which bodies are measured as either within or outside of the frame of normalized learning spaces such as schools. The Feminist Disability Studies and Disability Justice readings in the course go beyond labeling difference and invest in articulating and understanding difference as interconnected relationships in which inclusion may be fostered.

AED 536: Curriculum Development in Art Education

3 Credits

Factors affecting art curriculum decisions, analysis, selection, organization, preparation of curriculum. Evaluation and sources of art curriculum improvement and innovation.

Prerequisite: 6 credits of methods

AED 541: Theories of Child Art

3 Credits

Study of current theories of child art; application of recent psychological and anthropological theories to understanding child art.

Prerequisite: A ED 486

AED 570: Artistic Creation and Theories of Knowing

3 Credits

A thematically organized course that makes connections between art-making and art as a way of knowing and inquiry.

AED 588: History of Art Education

3 Credits

Historical development of philosophies in art education in the United States and abroad.

AED 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

AED 594: Research Topics

1-18 Credits/Maximum of 18

Supervised student activities on research projects identified on an individual or small-group basis.

AED 595: Internship

1-18 Credits/Maximum of 18

Supervised off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

AED 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

AED 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

AED 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

AED 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

AED 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Teaching of undergraduate art education classes under the supervision of two members of the graduate faculty.

Prerequisite: doctoral candidate status in Art Education and program head permission

AED 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

AED 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

AED 811: New Media and Pedagogy

3 Credits

Exploration of relationships between communication technologies and beliefs about the nature of knowledge and the nature of art. AED 811 New Media and Pedagogy (3) Due, in part, to contemporary processes of globalization and the development of digital technologies and the Web; new issues, possibilities, and opportunities regarding media communities and art pedagogy emerge in the field of art education. This is the focus of this course. Course participants have the opportunity to explore the aesthetic communicative and pedagogical implications of intertextual Webs, hypertext and hypermedia, blogs, wikis, simulations, the body interfaced in virtual reality, threaded dialogue, WebQuests, online games, media communities, adaptive and assistive technologies, and media-rich essays. Learning activities will be in the form of explorations and creation with the links and resources provided, and focused discussions about these explorations and how to teach this content at participants' teaching sites. Following 5 thematic explorations, course participants write a capstone essay to construct a speculative fiction of a teaching scenario based on the content of the course imagined in a future teaching site. The main priorities in Exploration 1 are to imagine possibilities of human-technology interfaces for creating and critiquing art. In Exploration 2, participants select a social networking tool from the course's resources to conduct a collaborative mini-project concerning self-representation online and power relational networks of social, physical, technological, and discursive inscriptions or conditions. Exploration 3, involves using the Internet as a primary medium for art creation and involves developing criteria to critique interactive Net art. The focus of Exploration 4 is free, downloadable authoring programs outside of a commercial economy, which enables the creation of interactive experiences without the need for specialized programming knowledge or database support. Exploration 5 involves participants creating a socially responsive visual culture WebQuest, which is an inquiry-oriented activity in which learners construct knowledge through interacting with, evaluating, and connecting diverse, and sometimes contradictory, resources on the Internet in order to form new insights that they share in a tangible form intended to make a difference in the world. This is one of the required courses for the M.P.S. in Art Education. There is no prescribed sequence and no prerequisites for art education courses in the M.P.S. program.

AED 812: Diversity, Visual Culture, and Pedagogy

3 Credits

Diversity issues in museum and K-12 art education contexts. AED 812 Diversity, Visual Culture, and Pedagogy (3) This course examines diversity, visual culture, and pedagogy in various settings: the artworld, popular media, and cultural settings such as schools and museums. Diversity pertains to gender, sexual identity, social class, ethnicity, ability, age, and other attributes that shape our identities. This course pays special attention to issues of power and privilege in relation to diversity and visual culture. It examines ways that various forms of visual culture, situated in various social contexts, teach us who we are, what is "normal" in our society, and how we might change oppressive social conditions that currently exist. As defined in the course, visual culture includes paintings, sculptures, prints, and other forms of fine art as well as advertisements, news images, scientific images, television programs, and films. It includes toys, comic books, children's art and more. Visual culture includes all manifestations of cultural life that are significant for their visual features. Pedagogy refers not only to formal methods of instruction, such as teaching and learning in classrooms. It also includes informal instruction through the arts, the media, popular forms

of entertainment, and other social practices. Pedagogy includes being positioned by, or addressed in certain ways by various forms of visual culture. It includes the ways we actively interpret, use, and recreate forms of visual culture in our lives. Objectives of the course include understanding diversity as defined in relation to various forms of visual culture; understanding the complex interactions of ethnicity, class, gender, sexual identity, and other aspects of diversity in visual culture; understanding issues of power and privilege in relation to visual culture; and understanding pedagogical issues related to visual culture, including forms of address and interpretation, as well as pedagogical practices such as teaching and learning in classrooms. By the end of the course, participants should be able to critically examine social constructions of race, class, gender, sexual identity, and other aspects of diversity in visual culture through both written and visual analyses. Participants should also be able to develop and implement units of instruction related to visual culture, and reflect on their own and others' teaching practices in schools and museums. This is one of the required courses for the M.P.S. in Art Education. It is offered every other year with a maximum enrollment of 15 students.

AED 813: Public Pedagogy

3 Credits

Inquiry into the public pedagogy of contemporary visual culture for relevancy to museum and K-12 art education contexts. AED 813 Public Pedagogy (3) This course prepares art teachers to become producers of a socially just world by becoming critical public art pedagogues who extend their teaching environment. As defined in the course, critical public pedagogy of art, as an educational and artistic practice, is a critical stance concerning socio-pervasive artifacts, processes, and interfaces that acculturate and assimilate values, beliefs, and sensitivities. Public pedagogy is the use of a public medium and/or space such as the Internet, films, television, magazines, shopping malls, and sports arenas to influence behaviors and beliefs. Public pedagogy enacts societal curricula that are easily consumed because of its ubiquitous nature. Awareness of consumption of public pedagogy is important because of its global reach. Educators need to be versed in how to facilitate investigations of public pedagogy and how to guide students to develop critical public pedagogical practices. From spheres of influence radiating from art to a multidirectional layered matrix of sensibility, this course explores contemporary art that addresses and enacts public pedagogy through (inter)actions of cultural interfaces such as humans, technologies, localities, and politics. Such artworks are performed networks of relations. Contemporary artists' praxis involving intertextuality, palimpsest, remix, code-switching, double-coding, subversion, and hypersignification is explored through video, installation, performance, and other contemporary art forms. Objectives of the course include understanding processes of consumption and production of public pedagogy, and understanding contemporary art practices. By the end of the course, participants should be able to develop and implement units of instruction related to contemporary art and public pedagogy, and reflect on their own and others' teaching practices in schools and museums. This is one of the required courses for the M.P.S. in Art Education. It is offered every other fall semester with a maximum enrollment of 15 students.

AED 814: Informal Learning

3 Credits

Pedagogy and contexts for learning in museums and other cultural institutions. AED 814 Informal Learning (3) The course introduces

participants to theories and practices of informal learning, and to the possible contexts including museums, schools and other cultural institutions in which informal, free choice learning may occur. These provide a framework for participants to use in preparing, implementing, and evaluating a learning project or other intervention in their own institutions or communities. The course includes a strategic and policy analysis of the contexts in which free choice learning projects may occur, a review of the social and economic significance of informal, free choice learning in an information age and global economy, an introduction and critical discussion of constructivist theories of informal learning, a review of specific pedagogical practices that may be effective in implementing informal learning for school-age students, adults, and senior citizens, an introduction to tools for evaluating the effectiveness of these practices, and the development, implementation and assessment of an informal learning project or intervention by each participant using other participants as consultants in the process. This is one of the required courses for the M.P.S. in Art Education. It is offered every other year with a maximum enrollment of 15 students.

AED 815: Action Research in Art Education

3 Credits

Develop a reflective process to improve strategies, practices, and knowledge of the environments within which art education is practiced. A ED 815 Action Research in Art Education (3) This course prepares M.P.S. in Art Education candidates to conduct action research in their teaching context as part of a community of practice by recognizing and sharing existing tacit knowledge about teaching and learning conceptualized in specific social and physical environments. Action research is a reflective and iterative inquiry process with the aim of improving strategies, practices, and knowledge of the environments within which one teaches. Course participants will learn how to conduct research that develops, leads to, implements, and assesses a genuinely well-informed social action in the midst of an emerging teaching and learning landscape. The course uses a blend of Web technology, print, and other media to maximize flexibility without sacrificing professor and student interaction. Communication tools, including bulletin boards and e-mail, are used to foster a collaborative environment, providing participants with the opportunity to learn from one another about the unique schools and cultural institutions each comes from and as well as their varied professional experiences. A ED 815 will be offered via World Campus as an online course will be offered every spring semester. Enrollment will be limited to 15 students.

Art History (ARTH)

ARTH 511: Seminar in Ancient Art

3-12 Credits

Selected topics from the history of Greek and Roman Art.

ARTH 512: Seminar in Medieval Art

3-12 Credits

Original research into problems dealing with the art of the Middle Ages.

ARTH 513: Seminar in Renaissance Art

3-12 Credits

Investigations in the area of Renaissance art, centering around major masters and monuments.

ARTH 514: Seminar in Baroque Art

3-12 Credits

Investigations in the area of baroque art, centering around major masters and monuments.

ARTH 515: Seminar in Modern Art

3-12 Credits

Lectures, readings, reports, and discussions in the field of modern art.

ARTH 551: Historiography of Art History

1-6 Credits

The relationship between the definition of, and approach to, art-historical problems from Vasari to the present.

ARTH 560: Methods of Research in Art History

3 Credits

Preparation of graduate students for professional careers in academia and museum work, involving creation of publishable articles and grant writing. In the academic world, and particularly in the humanities, the publication of articles and books is understood to be a marker of success and, along with teaching skills, the basis on which appointments are made and tenure granted. Essential to this body of production is the execution and placement of one's research undertakings, skills that the "Methods Seminar" is designed to hone. No less valued by those who make appointments and offer promotion are the grants and fellowships that a candidate has won. Indeed, since research in art history involves travel to and residence at museum, library and archive sites- whether these be in North America or abroad-financial support is a necessity for most aspiring professionals and is regarded as evidence of external validation of their investigations. Training in "grant writing" is also covered in the seminar. Even before field work is undertaken, the investigator must be aware of the "state of research," work normally undertaken at one's own university library. In this domain there are better and worse ways of taking notes. The seminar discusses these methods and goes beyond them to consider the optimum means by which such records are organized and assembled prior to the delivery of papers and the production of articles. The nature of an oral presentation and a publishable paper are distinct activities and this difference needs to be learned. The more complex skills involved in the writing of articles, the securing of photographs and concomitant permissions, and the choice of the journal to which the "finished" piece should be submitted are dealt with at even greater length.

ARTH 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

ARTH 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

ARTH 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

ARTH 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

ARTH 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Supervised experience for teaching assistants in art history.

ARTH 603: Foreign Academic Experience

1-12 Credits/Maximum of 12

Foreign study and/or research approved by the graduate program for students enrolled in a foreign university constituting progress toward the degree.

Artificial Intelligence (A-I)

A-I 570: Deep Learning

3 Credits

Deep Learning has become a prevalent area and accomplished near-human level in image classification, speech recognition, and autonomous driving. This course will cover the foundations on Neural Networks and Deep Learning Networks and give students a practical understanding of the field of Deep Learning. It covers the core concepts of Deep Neural Networks, including the Convolutional Neural Networks for image recognition, Recurrent Neural Networks for sequence generation, and Generative Adversarial Networks for image generation, and more!

Prerequisite: STAT 500 Recommended Prep: Requires basic math-college calculus & linear algebra. Should be able to take multivariable derivatives & understand matrices, vectors operations & notations. Preliminary programming skills in Python are required.

A-I 572: Reinforcement Learning

3 Credits

Reinforcement learning, along with supervised learning and unsupervised learning, is one of the three basic types of machine learning. Applications of reinforcement learning span across medical intervention, robotics, game playing, autonomous driving, financial trading, and marketing, among many others. This course will cover the main theory and approaches of reinforcement learning, along with deep learning and common software libraries and packages.

Recommended Preparation: STAT 500 or equivalent: probabilities, gaussian distributions, mean, standard deviation, etc. Able to take

multivariable derivatives and understand matrices and vectors operations and notations. Preliminary skills in Python.

A-I 574: Natural Language Processing

3 Credits

Natural Language Processing (NLP) is a subfield of Artificial Intelligence. This course covers basic as well as advanced concepts to gain a detailed understanding of NLP tasks such as language modeling, text to speech generation, natural language understanding, and natural language generation. Students will learn the necessary skills to design a range of applications, including sentiment analysis, translating between languages, and answering questions. Throughout the course, the practical implementation of these applications with deep neural networks is also discussed.

A-I 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis, and which fall outside the scope of formal courses.

A-I 801: Foundation of Artificial Intelligence

3 Credits

Artificial Intelligence (AI) is the discipline that attempts to build and understand intelligent entities. Computers with human level intelligence would have a huge impact as intelligent systems with natural language processing, robotics, building networked assistants, speech recognition, and autonomous driving. This course will teach the foundations of AI and give students a practical understanding of the field. This course gives an overview of the core concepts of AI, including the intelligent agents, knowledge and reasoning, reinforcement learning, planning and acting, belief networks, computational learning, Markov decision process, and more!

A-I 804: Ethics of Artificial Intelligence

3 Credits

Artificial Intelligence (AI) is the use of machines to do tasks that seem to require human intelligence and cognitive skills (thinking, natural language, inference, decision making etc.) The Ethics of Artificial Intelligence is the young branch of applied ethics that seeks to study the far-reaching and diverse ethical issues that arise with the widespread and rapid integration of AI technologies into various aspects of our lives. The challenge is that we are in an uncharted ethical territory with regard to AI: we need to radically adjust our existing ethical paradigms or introduce new ones as we experience and acquire a better grasp of the problems involved in AI-human interaction. A large portion of these issues reflect our concerns about the harm that the use and misuse of AI might cause for humanity. Such issues range from threats to individual privacy and freedom to wider social implications regarding economic justice and race and gender equality. However, as AI systems develop and attain higher levels of intelligence, questions about their moral status become more pressing. If these systems are capable of moral agency, then not only do they have responsibilities towards other moral agents like us, but they also have rights that we should respect in our conduct towards them. This course offers an overview of the nature and extent of the ethical issues arising from AI-human interaction as well as the philosophical background (particularly, in ethics and philosophy of mind) required to

develop an informed methodology in approaching these issues, with the help of the flourishing literature on the subject.

Cross-listed with: PHIL 804

A-I 879: Machine Vision

3 Credits

This course will focus on the design of computer-based, machine vision systems using appropriate algorithms and best practices. Students will study various techniques for image representation and structuring, feature extraction and segmentation, information extraction, filtering and analysis.

A-I 894: Capstone Experience

3 Credits

The capstone course in the MPS in Artificial Intelligence program. A practical experience in which students, working in teams, employ contemporary methods, process, and tools in the design and implementation of an AI-enabled system including problem identification, methodology selection, data identification and gathering, implementation, training, and deployment. As the culminating experience in the AI program, students demonstrate their ability to design and implement a full AI-enabled systems using a real-world dataset applying the tools and techniques explored throughout their preceding studies.

A-I 897: Special Topics

1-3 Credits/Maximum of 3

Formal courses given on a topical or special interest subject with a professional orientation that may be offered infrequently.

Asian Studies (ASIA)

ASIA 501: Proseminar in Asian Studies I

1-3 Credits

A seminar for graduate students in the Asian Studies dual-degree PhD programs.

ASIA 502: Proseminar in Asian Studies II

1-3 Credits

Introduction to theories, methods, and disciplines of Asian Studies.

ASIA 530: East Asian Philosophy and Culture

3 Credits

This course provides students with a comprehensive overview of key philosophical issues in the East Asian traditions. It aims to familiarize students with the most prominent critical debates and philosophical concerns, as well as the latest state of the field. Students will read philosophical texts alongside the critical literature in order to deepen knowledge of and evaluate philosophical discourse in East Asia from ancient times to the present. The course exposes students to the general philosophical canon as well as a range of current philosophical scholarship on how East Asian philosophy is being pursued today. Critical analyses and philosophical texts are chosen so as to illuminate each other and highlight key areas concerning ethics, metaphysics and cosmology, political philosophy, and culture. At the end of the course,

students will have gained a sound grasp of East Asian philosophy and its historical dimensions, and they will have developed a critical understanding of the current challenges and directions in the field. No prior knowledge of Classical Chinese is required, as all texts will be read in translation.

Cross-listed with: PHIL 530

ASIA 531: History of the Book in East Asia

3 Credits

This course provides a thorough grounding in the state of the field of book history in China, Korea, Japan, and Vietnam. It will begin with an overview of book history in general and East Asian book history's place within the larger field, followed by an overview of the history of reading and reading practices. Subsequent topics include technologies of book production, from oracle bones to xylography; the social and economic impact of printing; reading practices; the spread of knowledge and techniques across East Asia; and changes to the archive occasioned by born digital materials. Students will read secondary materials in English and use the library's special collections to examine material objects. Students will come away with sufficient knowledge to teach courses in the history of the book or conduct original research. It will be useful to students interested in alternative career paths, such as librarian or curatorial work. Knowledge of an Asian language is not required.

ASIA 532: Critical Studies in Global Korean Literature and Culture

3-6 Credits

This course provides students and overview of key texts and trends in modern Korean literature and culture from a global perspective. It examines the most prominent literary and visual works that articulate the intricacy of modern Korean culture at the intersections of major historical, ideological, and environmental forces and issues in the twentieth century such as colonialism, cultural imperialism, Cold War politics, democratic movement, feminist movement, environmental injustice, etc. Students will also read texts on modern Korean history as well as literary and cultural criticism and theories to improve their analytical ability that will be demonstrated in their writings.

Recommended Preparation: Students are expected to read in the original when they are capable. However, in anticipation of a broad array of language abilities in the classroom, materials will also be made available in English translation.

Cross-listed with: CMLIT 532

ASIA 577: Critical Perspectives on Modern Chinese Literature

3 Credits

This course provides students with an overview of the core texts and main critical paradigms of modern Chinese literary studies. This course provides students with a comprehensive overview of the main critical approaches to modern Chinese literature, by placing these paradigms into historical perspective and linking them with key texts that illuminate the authors' arguments and demonstrate exemplary readings that have proven influential in the field, past and present. The particular focus of the course may vary according to the instructor (e.g. themes, genres, regions etc.), but the course will generally cover critical interventions and debates, helping students to understand the emergence of the field in its present form; they will also scrutinize major trends that are providing new directions for the study of modern Chinese literature. In addition to the critical literature, students will read a range of key literary texts, from

the late Qing to the twenty-first century, that provide insights into the forces (aesthetic and intellectual, as well as social and historical) that have shaped the canon of modern Chinese literature. Critical analyses and literary texts are chosen in a way so as to illuminate each other. At the end of the class, students will have gained a sound grasp of the field and its literary and historical dimensions, and develop a critical understanding of the current challenges and directions of the study of modern Chinese literature. Cross Listings: CMLIT 577 will be added as a cross-listed course.

Cross-listed with: CMLIT 577

ASIA 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

ASIA 597A: Digital Humanities

3 Credits

This seminar will function as a workshop and laboratory for sampling, exploring, and experimenting with a variety of computer-based technologies that are currently being applied to (typically) large corpuses for the purposes of algorithmic criticism. Our focus will be hands-on experimentation with software for network analysis (gephi); stylistics (R); topic modeling (mallet), and mapping, with attention paid to foundational ideas of information theory, visualization, spatial humanities, etc. Exploration of further topics and methods according to student interests, preparation, and usefulness for specific research agendas.

Cross-Listed

Astrobiology (ABIOL)

ABIOL 570: Astrobiology Field Experience

2 Credits

Geological field excursions to sites where the early evolution of life and the environment is revealed and to modern analogues. ABIOL 570 Astrobiology Field Experience (2) Astrobiology is a new, multidisciplinary field of science encompassing astronomy, biology, biochemistry, genomics, chemistry, atmospheric chemistry, geochemistry, paleontology, geology, and many other fields of science and technology. Astrobiology includes the study of the origin of life, the connections between the evolution of life and of environments, the potential for life and life's actual distribution in our solar system and beyond, and future of life on Earth and in space. This course is intended to expose students to a variety of rock units (paleosols, sedimentary rocks, glacier deposits, ore deposits, and igneous rocks) formed under a variety of environments during the period between 3 billion years and 400 million years ago in order to give them some ideas about the environments of the early Earth. Students will also be exposed to a variety of geochemical, paleontological, and geological methods to investigate these ancient rocks in order to obtain information about the biological and chemical environments of the early Earth. The field excursion will be held for about two weeks during the Summer semester. It will be preceded by a short series of seminar-style meetings late in Spring semester to discuss the objectives of the excursion and to outline the major features of the field sites to be examined. Possible sites for the excursion will be selected from the Precambrian rocks in Ontario - Quebec, Canada, Michigan,

Minnesota, Wisconsin, New York, Virginia, West Virginia, and Maryland and modern microbial ecosystems in the Bahamas and Green Lake (NY). One to three days will be spent at each of the major sites. This is a required course for all students in Dual Title Degree Program in Astrobiology, but is open to any graduate student. This will also be a suitable course for undergraduate students, seniors preferred, with the permission of the instructor. There is no prerequisite. Grading will be based on a term paper submitted within one month after the excursion. The term paper will be based on literature review and field observations on a topic selected by each student.

ABIOL 574: Planetary Habitability

3 Credits

Aspects of star and planet formation, habitable zones, biospheric evolution, life in extreme environments, planet and life detection. ABIOL 574 Planetary Habitability (3) This course introduces graduate students to the foundations of the field of Astrobiology. Astrobiology is a new, multidisciplinary field of science encompassing astronomy, biology, microbiology, biochemistry, genomics, chemistry, atmospheric chemistry, geochemistry, paleontology, geology, and many other fields of science and technology. Astrobiology includes the study of the origin of habitable planets, origin of life, the connections between the evolution of life and of environments, the potential for life and life's actual distribution in our solar system and beyond, and future of life on Earth and in space. Students will expand their knowledge base beyond their discipline while considering such issues as the origins of stars and planets, environmental conditions of the prebiotic Earth, the origin of life on Earth, the nature of the universal "tree of life", the establishment of evolutionary patterns and rates, the causes of global glaciations and their use as analogues for life on planets or moons such as Europa, how life survives in extreme environments on Earth, what determines planetary habitability, how planets in other solar systems are detected, and how we might detect life on other planets. This is a required course for all students in Dual-Title Degree Program in Astrobiology, but is open to any qualified undergraduate or graduate student. There is no specific prerequisite. Grading will be based on participation and performance on a midterm and final examination, problem sets, and laboratory exercises.

ABIOL 576: The Search for Extraterrestrial Intelligence

3 Credits

This course offers a broad exploration of the Search for Extraterrestrial Intelligence (SETI) as a subfield of astrobiology. It includes a survey of background astronomy and radio engineering concepts necessary to read and analyze the professional literature on the topic, including foundational works and the state-of-the-art. It takes a broad view of SETI, including communication SETI (i.e. radio and optical searches), artifact SETI (search for non-communicative evidence of engineering), and a critical analysis of the assumptions and potential biases inherent in past and current SETI efforts. It also includes discussion of SETI's place in the popular, political, and scientific landscapes.

RECOMMENDED PREPARATION: Undergraduate degree in an astrobiology discipline, such as physics, astronomy, biology, or geology (and their subdisciplines), including familiarity with research methods. Because little field-specific knowledge is presumed of s
Cross-listed with: ASTRO 576

ABIOL 590: Astrobiology Seminar

3 Credits/Maximum of 6

Astrobiology is a multidisciplinary field of science encompassing astronomy, biology, biochemistry, genomics, chemistry, atmospheric chemistry, geochemistry, paleontology, geology, and many other fields of science and technology. Astrobiology includes the study of the origin of life, the connections between the evolution of life and of environments, the potential for life and life's actual distribution in our solar system and beyond, and future of life on Earth and in space. The main focus of lectures, discussions, and projects will be on new and important research developments within the interdisciplinary field of Astrobiology. Additionally, classic literature relevant to each topic will be covered to provide students with important context and principles.

ABIOL 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

Astronomy and Astrophysics (ASTRO)

ASTRO 501: Fundamental Astronomy

3 Credits

Concepts, tools and techniques, and essential background in stellar, Galactic, extragalactic astronomy and cosmology.

ASTRO 502: Fundamental Astrophysics

3 Credits

Fundamental tools and results of modern astrophysical theory. Gravitation; gas dynamics; radiation processes; radiative transfer; atomic structure and transitions.

ASTRO 504: Extragalactic Astronomy

3 Credits

Properties and evolution of galaxies including their stellar, interstellar, black hole and Dark Matter components.

Prerequisite: ASTRO501 , ASTRO502**ASTRO 513: Observational Techniques in Astronomy**

3 Credits

Theoretical and practical aspects of modern multiwavelength observational astrophysics including detector physics, imaging techniques, spectroscopic techniques, and data analysis principles.

Prerequisite: ASTRO501 , ASTRO502**ASTRO 515: Astrostatistics**

3 Credits

Modern astronomical research – the study of planets, stars, galaxies and the Universe – and the linking of observational data to astrophysical theory encounter a wide array of challenges falling under the rubric

of statistical inference. Cosmology, for example, addresses spatial clustering of galaxies, nonlinear regression of Big Bang astrophysical models, supervised regression of galaxy photometric redshifts, multiple hypothesis tests for faint source detection in images, multivariate classification, and time series analysis of billion-object multi-epoch surveys. Big Data arising from large-scale astronomical surveys and Bayesian modeling of astrophysical models are propelling astrostatistics into greater importance than in the past. Yet the curriculum for young astronomers typically includes no courses in statistical methodology. This course is designed to fill this gap. The course progresses through three stages. First, basic principles in statistical inference are presented and discussed including elements of probability theory, point and interval estimation, and probability distributions. The techniques of least squares, maximum likelihood, and Bayesian inference are outlined here and exercised later in the course. Second, central fields of applied statistics are investigated including nonparametric statistics and density estimation, regression (including nonlinear models from astrophysical theory), and multivariate analysis (including unsupervised clustering and supervised classification). Specific statistical methods are linked to specific astronomical problems at each step. Third, the instructor and students choose topics for study, such as time series analysis, spatial point processes, censoring and truncation, Bayesian computation, and scientific visualization. Common characteristics of astronomical data that are not treated in standard statistical presentations are discussed in detail, including heteroscedastic measurement errors, irregularly-spaced time series, and nonlinear astrophysical models. A crucial element of the course is practical training in the implementation of these statistical methods using sophisticated public-domain software environments. Software tutorials in class and text help educate the student to a level where data and science analysis can proceed at a mature level.

ASTRO 527: Computational Physics and Astrophysics

3 Credits

This course provides an advanced overview of applications of numerical methods and computer programming to physics and astrophysics. Numerical calculations provide a powerful tool for understanding physical phenomena, complementing laboratory experiment and analytical mathematics. The main objectives of the course are: to survey the computational methods used for modeling physical and astrophysical systems; to apply the computational methods to solve real world problems in physics and astrophysics; to assess the reliability of numerical results using convergence tests and error estimates; and to use scientific visualization as a tool for computer programming development and for physical understanding of numerical results. Strong programming skill in any of the common programming languages such as C, C++, or Python, is highly recommended.

Recommended Preparations: Strong programming skills are highly recommended.

Cross-listed with: PHYS 527

ASTRO 528: High-Performance Scientific Computing for Astrophysics

3 Credits/Maximum of 999

Training in software development for performing astrophysical simulations and analyzing astronomical data, including attention to reproducibility, parallelization, and computing architectures.

CONCURRENT COURSE: ASTRO 501

ASTRO 530: Stellar Atmospheres

3 Credits

The structure, physics and observational manifestations of atmospheres of stars.

Prerequisite: ASTRO501 , ASTRO502

ASTRO 534: Stellar Structure and Evolution

3 Credits

Physics of stellar interiors, stellar structure, and evolutionary changes of stars from pre-main sequence through final states.

Prerequisite: ASTRO501 , ASTRO502

ASTRO 542: Interstellar Medium and Star Formation

3 Credits

Theory and observation of the interstellar medium of our Galaxy and the process of star and planet formation.

ASTRO 545: Cosmology

3 Credits

Modern cosmology of the early universe, including inflation, the cosmic microwave background, nucleosynthesis, dark matter and energy. ASTRO (PHYS) 545 Cosmology (3)Cosmology is the scientific study of the universe as a whole: its physical contents, principal physical processes, and evolution through time. Modern cosmology, which began in the early 20th century, is undergoing a renaissance as a precision science as powerful ground- and space-based telescopes allow us to observe the formation of the first stars, galaxies and galaxy clusters; the echoes of the inflationary epoch as they are impressed upon the cosmic microwave background; and evidence for and clues to the nature of the mysterious dark energy, which is driving the accelerating expansion of the universe. This course will introduce students to the key observations and the theoretical framework through which we understand the physical cosmology of the early universe.

Cross-listed with: PHYS 545

ASTRO 550: High Energy Astrophysics

3 Credits

Theory and observations of X-rays, gamma-rays and other high energy radiation from Galactic and extragalactic sources.

ASTRO 570: Particle Astrophysics

3 Credits

Particle astrophysics is a discipline at the interface between physics and astronomy, which has undergone tremendous growth in the 21st century, with the commissioning and exciting results from very large facilities detecting the highest energy cosmic rays, neutrinos, gravitational waves, and gamma-rays. There is a rapid and ongoing expansion of the understanding of these radiations, their physics and their sources, which include supernovae, gamma-ray bursts, and active galactic nuclei, and there are major new facilities aimed at characterizing particle properties of dark matter and its cosmological effects. Students will be given an overview of the basics of particle astrophysics and to the latest data and

its interpretation, stressing issues currently discussed by the community, with particular attention on major projects in which Penn State faculty are involved. The course is designed for graduate students in physics and astronomy and astrophysics, being also appropriate for students in nuclear engineering or related disciplines.

Prerequisites: ASTRO 502; PHYS 400; PHYS 406 PHYS 557

Cross-listed with: PHYS 570

ASTRO 576: The Search for Extraterrestrial Intelligence

3 Credits

This course offers a broad exploration of the Search for Extraterrestrial Intelligence (SETI) as a subfield of astrobiology. It includes a survey of background astronomy and radio engineering concepts necessary to read and analyze the professional literature on the topic, including foundational works and the state-of-the-art. It takes a broad view of SETI, including communication SETI (i.e. radio and optical searches), artifact SETI (search for non-communicative evidence of engineering), and a critical analysis of the assumptions and potential biases inherent in past and current SETI efforts. It also includes discussion of SETI's place in the popular, political, and scientific landscapes.

RECOMMENDED PREPARATION: Undergraduate degree in an astrobiology discipline, such as physics, astronomy, biology, or geology (and their subdisciplines), including familiarity with research methods. Because little field-specific knowledge is presumed of s
Cross-listed with: ABIOL 576

ASTRO 577: Exoplanets

3 Credits

Recommended Preparations: Some assignments will require programming in the student's programming language of choice. Since the early 1990s, thousands of exoplanets have been discovered orbiting other stars beyond our solar system. The properties of these planets have challenged our understanding of how planetary systems form and evolve. This course will cover theories of exoplanets' formation and evolution, the discovery and characterization of exoplanets via exoplanet signals, and the physical properties of exoplanets, including prospects for habitability.

ASTRO 585: Topics in Astronomy and Astrophysics

3 Credits

Advanced study of issues in planetary, stellar, galactic, extragalactic and theoretical astronomy and astrophysics. ASTRO 585 Topics in Astronomy and Astrophysics (3)This 3-credit topics course will be offered as part of the regular sequence of graduate offerings, and can be used to fulfill the graduate degree course requirements on an equal basis with ASTRO 501-580 3 credit courses. The purpose here is to provide a flexible environment for full courses on subjects that are not covered in the courses with fixed curricular content and are important to Penn State faculty, research Centers, and students.

Prerequisite: ASTRO501 , ASTRO502

ASTRO 588: Seminar in Astronomical Research Development and Responsible Conduct

1 Credits

The course includes a variety of topics related to ethics and professional development in Astronomy and Astrophysics. The course builds from

the mandatory training students receive from Scholarship and Research Integrity. The content is geared toward providing students with "survival skills" that are not encountered in the typical course curriculum. Topics include research paper writing, proposal writing, postdoctoral job applications, career options in research/education and outreach/observatory support/data science/policy, professional networking, effective dissemination of research, funding landscape in the profession, etc.

ASTRO 589: Seminar in Current Astronomical Research

1 Credits

Contemporary issues in instrumental, observational and theoretical astronomy and astrophysics. ASTRO 589 Seminar in Current Astronomical Research (1) This seminar will be offered as part of the regular sequence of graduate offerings, and is also used to fulfill the graduate degree course requirements for 1-credit seminars. Their purpose is to treat focused issues of current research interest. Examples are: Physics of Gamma-ray Bursts, Design of Precision Spectrographs, Quasar Surveys, Protoplanetary Disks. This course is taught by Department faculty, researchers and visitors.

Prerequisite: ASTRO501 , ASTRO502

ASTRO 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

ASTRO 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

ASTRO 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given infrequently to explore, in depth, a comparatively narrow subject which may be topical or of special interest.

ASTRO 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

ASTRO 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

ASTRO 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

No description.

ASTRO 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

ASTRO 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

ASTRO 801: Planets, Stars, Galaxies, and the Universe

3 Credits

Overview of the structure, formation, and evolution of planets, stars, galaxies, and the universe. Topic: Observations by modern ground-based and space-based observatories have fueled significant changes in our understanding of the Universe. The Solar System contains only 8 planets but has many thousands of Kuiper Belt Objects, including Pluto. Large area sky surveys have taken inventory of the stars in the Milky Way Galaxy and galaxies in the Universe and determined that only 4% of the mass of the universe is found in luminous objects. Besides the mysterious "dark matter," we now know that the energy budget of the universe is dominated by "dark energy," which is causing the expansion of the Universe to accelerate. ASTRO 801: Planets, Stars, Galaxies, and the Universe will provide science educators with a strong foundation in astronomy, allowing them to critically evaluate the evidence for the most recent advances in our understanding of the Solar System, our Galaxy, and the Universe. Astronomers use observations of the light from distant sources to discover the nature of these objects and their environment. ASTRO 801 will lead students to an understanding of light and the instruments for its detection. They will see how careful analysis of these observational data and theoretical models are used to solve the mysteries of the Universe. ASTRO 801 will combine digital video, audio, simulation models, and the wealth of astronomical imagery from NASA's Hubble, Chandra, and Spitzer Great Observatories. Students will use highly detailed planetarium software and simulated observing experiences to directly explore the night sky to make the same observations that research astronomers perform in their work. ASTRO 801 students will be granted licenses to use the courseware developed for this course in their own secondary classrooms.

ASTRO 897A: ****SPECIAL TOPICS****

2 Credits

ASTRO 897B: ****SPECIAL TOPICS****

2 Credits

Athletic Training (ATHTR)

ATHTR 500: Theory and Application of Evidence-Based Practice

3 Credits

This course provides a foundational overview of evidence-based practice (EBP) in the health sciences, which includes an overview of the seven steps of the EBP process. Conceptual models that demystify the process of translating research into clinical practice will be presented; furthermore, common misconceptions of EBP will be explored. Students will be exposed to organizational cultures that foster a spirit of inquiry, and contemporary attitudes to identifying sources of evidence to be considered in answering a focused clinical (or researchable) question.

An emphasis will be placed on developing core competencies in the gathering, and scrutiny of information to draw conclusions that are based on robust, inclusive, and meaningful evidence. Additional focus will consist of cultivating skill with implementing EBP in a manner that best fits the context of care/intervention, aligns with targeted goals, addresses priority problems as well as guides a systematic, and evaluative approach to collaborative practice change. Determinants of an EBP environment, and factors that lend to its sustainability or demise will also be discussed. Leveraging population health initiatives as a mechanism to move from silos to synergy will be highlighted given evidence to suggest an interdisciplinary paradigm to problem-solving yields improved health care processes, and patient/client-centered outcomes.

Concurrents: ATHTR 804 and ATHTR 805 and PHS 809
Cross-listed with: KINES 500

ATHTR 501: Science and Ethics of Human Performance Optimization

3 Credits

This course provides an overview of various biobehavioral factors that underpin the enhancement of human capabilities, including, but not limited to, kinesthesia, physical fitness, and motor coordination in diverse physically active populations. Using the clinician-scientist model, students are exposed to content that augments their skills in the discovery, appraisal, and dissemination of knowledge to benefit the species. Learning activities are structured to promote theory-practice nexus in the health sciences, and the advantages for doing so will be outlined. Gaining novice to advanced beginner competence with tests and measures employed in contemporary human performance science is emphasized. This will include becoming familiar with an array of related technological apparatuses, their utility, and viability in research, and practice settings. The intersections of human performance science, ethics, and regulation are also stressed to guide conscientious and legal practice. Competency in these domains facilitates appropriate application of contemporary theory and scientific findings in patient/client management to yield efficacious performance restoration and optimization of variables such as, but not limited to, postural control, rate of force development, and aerobic endurance. A key takeaway from this course will be the importance of integrating theory, research, and experiential practice to stimulate transformative and innovative environments.

Prerequisites: ATHTR 500 Concurrent: ATHTR 813, ATHTR 814

ATHTR 800: Foundations of Clinical Practice

4 Credits

This course provides a dedicated overview of athletic training using the most current Board of Certification Practice Analysis and Standards of Professional Practice as a framework for learning. Students will be exposed to regulatory determinants that govern athletic training as well as the cultural, ethical, psychosocial, and economical considerations that shape competent and compassionate health care. Factors related to maintaining contemporary expertise, meaningful professional development, and career advancement are also discussed. Emphasis is placed on fostering skill in information fluency/literacy to identify and appropriately use resources to guide safety and efficacy of services rendered. Content is structured to expand the student's knowledge base in health promotion and injury/illness prevention strategies as well as

sharpen skills linked to basic evaluation and diagnosis, therapeutic interventions, and restoring or optimizing human performance.

Concurrent: ATHTR 801

ATHTR 801: Principles of Acute Care and Emergency Response

4 Credits

This course provides an opportunity for students to become proficient in the knowledge and skills related to contemporary prehospital emergency medical care provided by athletic trainers. Students will develop skills to evaluate, manage, and make referral decisions for a spectrum of injuries and conditions in patients across a lifespan as part of a comprehensive medical system. Students will develop critical thinking and clinical decision-making techniques in provision of patient care.

Concurrents: ATHTR 800

ATHTR 802: Anatomical Basis of Musculoskeletal Injury

4 Credits

This course uses a regional approach to study the gross anatomical structures of the human body. Emphasis is placed on the musculoskeletal system and its associated neurovascular elements. Synovial joint structure and supporting soft tissue systems will be covered in detail. The thoracic, abdominal, and pelvic cavities will also be explored. Aspects of structure and function as they relate to physical training performance and clinical correlates will be highlighted throughout the course. Experiences with dissection of human cadaveric specimens highlight spatial associations among structures and anatomical variation.

Concurrents: ATHTR 803

ATHTR 803: Fundamentals of Musculoskeletal Evaluation

4 Credits

This will be the first in a series of evaluation-based courses for the Master of Athletic Training degree program, and will cover key concepts of the evaluative process. Material covered in this course will be reinforced in more detail throughout the curricular progression. Content will focus on the World Health Organization's International Classification of Functioning, Disability, and Health (ICF) as a basis for delivery, and communication of patient care. This will be the framework for integrating evaluation findings, and developing a plan of care including referral to the appropriate provider when indicated. This course will establish ethical standards of the profession that are congruent with clinical practice, which will be consistent throughout the curriculum. While the course will center on developing foundational musculoskeletal evaluation techniques, emphasis will also be placed on the management of patients with acute conditions that are life threatening or otherwise emergent. Students will learn to perform an evaluation that formulates a diagnosis, and plan of care for patients with health conditions commonly seen in athletic training practice. This evaluation includes the following: obtaining a medical history from the patient or other individual; identifying comorbidities and patients with complex medical conditions; selecting an appropriate outcomes measurement tool; observing function (including gait, posture and tissue appearance); performing strength and range of motion testing for the upper and lower quarters and the spine, and being able to select appropriate tests for individual scenarios; determining end-feel, and somatic responses associated with special tests that selectively examine the integrity of capsuloligamentous, and

musculotendinous structures; performing a neurologic screening exam including dermatomes, myotomes, deep tendon reflexes and cranial nerve testing; understanding contemporary pain theory and how to assess pain in a patient scenario; analyzing functional tasks specific to the individual, sport/activity and body part or injury. This course will also include an overview of the tissue healing cascade following injury as well as inflammatory response, swelling and dysfunction in the context of the ICF model.

ATHTR 804: Evaluation and Treatment of the Lower Extremities

4 Credits

This course will focus on the etiology, evaluation and rehabilitation of injuries to the lower extremities typically encountered by physically active individuals. Injuries to the lower extremities from the hip to the foot will be covered. Evaluation techniques along with manual therapy and exercise interventions will be explored. Appropriate use of devices, braces and taping as they apply to rehabilitation will be discussed. Both isolated and integrated function of lower extremity joints and related tissues will be emphasized.

Prerequisites: ATHTR 800 and ATHTR 801 and ATHTR 802 and ATHTR 803
Concurrents: ATHTR 500, and PHS 809, and ATHTR 805

ATHTR 805: Experiential Learning I

2 Credits

This represents the initial opportunity for athletic training students to engage in the application of theory and foundational athletic training, knowledge, and skills through hands-on patient/client care experiences for 10-to-15 hours per week (150-to-225 total hours for the semester). This clinical experience increases student awareness for the role of the athletic trainer as an allied health care professional. Students become familiar with the daily operating procedures of an athletic training facility while being exposed to the culture of the profession. Students at this level are able to apply clinical skills under the supervision of preceptors. These clinical techniques consist of neuromusculoskeletal injury prevention/screening strategies, prophylactic taping/wrapping practices, and fundamentals of injury examination, acute care, and emergency response. Application of therapeutic agents is limited to those categorized as infrared (e.g. cryotherapy and superficial thermotherapy). Rehabilitation techniques applied are limited in scope to basic interventions that consist of administering range of motion and progressive resistance exercises, as well as elementary neuromuscular control techniques as prescribed by supervising preceptors. Exposure to documentation and record-keeping is also characteristic of this experience. Patient/client populations for this level are student-athletes participating in collegiate or secondary school sports.

Prerequisite: ATHTR 800, ATHTR 801, ATHTR 802, ATHTR 803;
Concurrent: PHS 809, ATHTR 804, ATHTR 500

ATHTR 806: Evaluation and Treatment of the Upper Extremities

4 Credits

This course will focus on the etiology, evaluation and rehabilitation of injuries to the upper extremities typically encountered by physically active individuals. Injuries to the upper extremities from the shoulder to the hand will be covered. Examination techniques along with manual therapy and exercise interventions will be explored. Appropriate use of devices, braces and taping as they apply to rehabilitation will be

discussed. Both isolated and integrated function of upper extremity joints and related tissues will be emphasized.

Prerequisites: ATHTR 804
Concurrents: ATHTR 807, and ATHTR 808, and ATHTR 809

ATHTR 807: Clinical Interventions and Implementation: General Treatment Strategies

4 Credits

This course will provide athletic training students with the knowledge and skills necessary to effectively function as a versatile primary care service provider. This is accomplished by exposing students to an array of diagnostic and management strategies used across a broad range of health care services for diverse patient populations. Emphasis is placed on fostering critical thinking ability for guiding proper selection, and efficacious application of interventions with consideration to the unique parameters associated with a patient case and various practice settings. The breadth of knowledge acquired will prepare athletic trainers to function in a spectrum of clinical environments that span from sports medicine to ambulatory care.

Prerequisite: ATHTR 500 and ATHTR 801; **Concurrent:** ATHTR 806, ATHTR 808, ATHTR 809

ATHTR 808: Therapeutic Interventions: Approaches and Techniques

4 Credits

This course provides the theoretical underpinnings that drive clinical applications of therapeutic interventions in health care and human performance restoration practice settings. Bridging the gap between concepts and applications will be a cornerstone of this course as a means to promote knowledge translation that lends to efficacious use in the care of patient/client populations. An evidence-based practice approach is emphasized to account for and effectively balance the influence of scientific data, clinician expertise, and patient/client values in the critical decision-making process, which adheres to ethical standards, and recognizes financial implications. In this structure, students will be presented with problem-based learning activities aimed at developing critical thinking abilities when operating in diverse practice settings. The basis of such activities will serve to nurture the efficient identification of viable solutions, and their prioritization given available resources, and constraints associated with various simulated clinical scenarios. Students will be exposed to a wide array of contemporary interventions with a focus on implementation in the management of acute, persistent, and chronic neuromusculoskeletal pathology as well as human performance restoration for the physically active. Acquisition of knowledge will be complemented with activities that build clinical skills that foster practitioner awareness for proper use, which promotes sound habits in operational procedures.

ATHTR 809: Experiential Learning II

3 Credits

This reflects the second clinical education experience in the professional degree program. Students at this level build on the theory that underpins the psychomotor skills they were exposed to in preceding coursework. This is accomplished through patient/client encounters, and applicable simulation learning activities that range from 15-to-20. This reflects the second clinical education experience in the professional degree program. Students at this level build on the theory that underpins the psychomotor skills they were exposed to in preceding coursework.

This is accomplished through patient/client encounters, and applicable simulation learning activities that range from 15-to-20 hours per week (225-to-300 total hours for the semester). In addition to the supervised application of clinical techniques in real-world practice or simulated settings, students are provided with opportunities to advance their skills in the evaluation and treatment of neuromusculoskeletal injuries to the lower extremity and lumbopelvic spine. In this capacity, students begin to link evidence-based practice principles with the selection of relevant health care and human performance restoration/optimization interventions. Patient/client populations for this level are student-athletes participating in collegiate or secondary school sports. hours per week (225-to-300 total hours for the semester). In addition to the supervised application of clinical techniques in real-world practice or simulated settings, students are provided with opportunities to advance their skills in the evaluation and treatment of neuromusculoskeletal injuries to the lower extremity and lumbopelvic spine. In this capacity, students begin to link evidence-based practice principles with the selection of relevant health care and human performance restoration/optimization interventions. Patient/client populations for this level are student-athletes participating in collegiate or secondary school sports.

Prerequisite: ATHTR 500 and ATHTR 804 and ATHTR 805; Concurrent: ATHTR 806, ATHTR 807, ATHTR 808

ATHTR 810: Evaluation and Treatment of the Spine and Thoracic Cage

4 Credits

This course will focus on the etiology, evaluation and rehabilitation of injuries to the pelvic girdle, spine, thoracic cage and head typically encountered by physically active individuals. Evaluation techniques along with manual therapy and exercise interventions will be explored. Both isolated and integrated function of pelvic girdle, spine and thoracic cage and related tissues will be emphasized.

ATHTR 811: Experiential Learning III

2 Credits

This reflects the third clinical education experience in the professional degree program. Students at this level build on the theory that underpins the psychomotor skills they were exposed to in preceding coursework. This is accomplished through patient/client encounters and applicable simulation learning activities that range from 20-to-30 hours per week (120-to-180 total hours for a six-week summer session). In addition to the supervised application of clinical techniques in real-world practice or simulated settings, students are provided with opportunities to advance their skills in the evaluation and treatment of neuromusculoskeletal injuries to the upper extremity and implementation of interventions for a broad spectrum of conditions encountered in the daily operation of a comprehensive sports health care enterprise. In this capacity, students enhance their proficiency in using evidence-based practice to guide selection of relevant health care and human performance restoration/optimization practices. Patient/client populations for this level are student-athletes participating in collegiate or secondary school sports. This course also provides students with exposure to the primary care of non-orthopaedic conditions and in the supervised application of practices with non-sport populations. Organized inter-professional education activities are designed to expand the scope of student awareness for criticality of interdisciplinary collaboration to prevent errors and improve patient experiences that yield efficient clinical outcomes.

Prerequisite: ATHTR 806 and ATHTR 807 and ATHTR 808 and ATHTR 809; Concurrent: NURS 802 and NURS 802A

ATHTR 812: Elective Clerkship

1-6 Credits/Maximum of 6

This elective course offers students a broad array of potential clerkships that foster growth of professional knowledge, skills, attitude, and habits through direct patient/client care experiences, pedagogical, and/or research training opportunities. The engaged learning experiences that students may participate in are many and diverse. Students are assigned to a faculty member who provides direction in shaping objectives of the clerkship. Faculty will also be responsible for organizing individualized learning activities that contribute to the student achieving their identified goals for the experience. For clerkships that entail patient/client care, students will be assigned to a preceptor who supervises related duties. Students may also pursue pedagogical or research training opportunities to prepare them for a potential career as a clinician-educator or clinician-scientist through this clerkship. The course provides opportunities to augment critical thinking skills via deliberate active learning exercises, and hands-on activities. The role of the elective is to provide experiences that enrich and expand knowledge to help prepare students for choosing and succeeding in the professional practice setting or advanced training program of their choice.

Prerequisite: ATHTR 809

ATHTR 813: Administrative and Professional Aspects of Health Care

3 Credits

This course is designed to provide students with professional knowledge of the administrative aspects of delivering athletic training services in healthcare systems. General topics include theory and application of management strategies, healthcare policies and procedures, law and ethics, and leadership evaluation and assessment.

Concurrents: ATHTR 501, ATHTR 814

ATHTR 814: Experiential Learning IV

6 Credits

This represents the fourth clinical education experience in the professional degree program. Students at this level are challenged to progress their professional knowledge and skills through graduated supervised clerkship activities that allow for autonomous experiences needed to prepare them to make clinical decisions. In order to maximize such opportunities through patient/client interactions, students are exposed to learning exercises that are carefully structured to elevate their competence from novice to advanced beginner. Along with connecting theory to practice across a spectrum of clinical conditions, students are presented with activities that accentuate biomedical and ethical considerations in human performance and optimization interventions. Corresponding links to health care administration and professional responsibility are also emphasized to ensure fluency/literacy in this practice domain.

Prerequisite: ATHTR 810 and NURS 802 and NURS 802A and ATHTR 811; Concurrent: ATHTR 501 and ATHTR 813

ATHTR 815: Seminars in Sports Health Care

3 Credits

This course is designed to provide students with knowledge that lends to their professional development through interactions with an array of personnel who operate in the broad spectrum of sports health care. Content spans domains and tasks linked to the most current edition of the practice analysis established by the Board of Certification for the Athletic Trainer. Examples include, but are not limited to: health conditions and occupational risks in novel groups, telehealth, and mass causality incident response. Potential benefits, limitations, and harms of clinical guidelines will also be explored. The significance of meaningful continuing education, lifelong learning, and developing leadership attributes to preserve contemporary expertise will be emphasized. Scholarship is structured to cultivate appreciation for diverse disciplines that contribute to evolving the art and science of the craft. The course will reinforce the criticality of integrating theory, research, and experiential practice to stimulate transformative and innovative environments in health care and human performance optimization industries.

Concurrent: ATHTR 816 and ATHTR 817**ATHTR 816: Experiential Learning V**

6 Credits

This final experiential learning course facilitates the graduating athletic training student's entry into the profession. Active learning centers on the ever-changing health care delivery system, human performance improvement industry, and the athletic trainer's evolving roles, responsibilities, and scope of practice within them. Legal, ethical, and socio-political considerations of the profession are also explored. Moreover, accountability for integrating sound quantitative evidence, and experience into clinical practice is stressed. Guidance in completing applications for the national board of certification exam and state credentialing to legally practice athletic training is provided.

Prerequisite: ATHTR 814; **Concurrent:** ATHTR 815 and ATHTR 817**ATHTR 817: Creative Knowledge Translation**

3 Credits

This course is designed to serve as a mechanism by which students engage in scholarly work through a series of guided, and self-directed knowledge translation activities that involve the integration of skills acquired throughout the academic plan. Project-based learning is tailored to yield a culminating experience in the professional degree program that prepares students for transition to practice. The outcome of these knowledge translation activities manifests through the completion of an independent project that demonstrates a student's aptitude for generating solutions to real-world challenges or problems in clinical, academic or administrative affairs linked to the profession. Projects may take various creative forms and are developed to be personally meaningful. Examples of projects may include, but are not limited to, a systematic review, meta-analysis, critically-appraised topic, case study or series, and original research. The course also serves to provide interactions that help shape a student's projected career trajectory as it pertains to post-graduate practice settings or pursuing advanced training programs.

Prerequisites: ATHTR 501, ATHTR 813, ATHTR 814 **Concurrent:** ATHTR 815, ATHTR 816**ATHTR 897: Special Topics**

1-9 Credits/Maximum of 9

Formal course given infrequently to explore, in depth, a comparatively narrow subject that may be topical or of special interest.

Biobehavioral Health (BBH)**BBH 501: Biobehavioral Systems in Health and Development: Theory and Processes**

3 Credits

Examination of theories and basic processes for understanding individuals as dynamic biobehavioral complex systems functioning through continual inter- actions. BB H 501BB H 501 Biobehavioral Systems in Health and Development: Theory and Processes (3)Understanding the etiology of illness and the design of intervention strategies for promoting healthy development, preventing illness, and accomplishing remediation and rehabilitation require a multidisciplinary understanding of the theoretical basis of normal healthy human development and the complex biological processes that form the basis of health and development. This course (BB H 501) presents the theoretical framework of humans as complex dynamic systems, followed by modules on processes of cell biology and genetics as complex systems. The second course (BB H 503) continues with modules of the processes of neurobiology, endocrinology, immunology, and pharmacology followed by a section on integrative biology and health. The modules of biological processes are developed from the perspective of how the physiological aspects of the area of biology is relevant to behavioral development and on what aspect of this area of biology is linked to behavior. These processes are considered in the context of their role in the comprehensive theoretical models developed in the first section of the course. Similar integration with a primary emphasis on behavioral processes is offered in other courses that form the core graduate curriculum in Biobehavioral Health. Evaluation of the theories section will be by written exam, oral presentation, and seminar participation. Evaluation of the cell biology, genetics, and neurobiology components will be by written exam for each component. This initial required course in the biobehavioral health sequence is designed to provide a multidisciplinary framework of theory and knowledge of biobehavioral processes and their implications for health and illness on which other biobehavioral health courses can build. It is the first of a two-course sequence (BB H 501 and BB H 503). It will be required by all graduate majors in Biobehavioral Health. It will be available to students in other doctoral programs it could be a part of a Biobehavioral Health minor for other students. This course will be offered every fall semester beginning with the first fall semester after approval and will enroll a maximum of twenty students.Faculty: George Vogler and Byron Jones

Prerequisite: graduate status**BBH 502: Health: Biobehavioral Perspectives**

3 Credits

Introduction to the role of psychology in maintaining health and in treating nonpsychiatric disorders.

Cross-listed with: PSY 502

BBH 503: Biobehavioral Systems in Health and Development: Processes and Integration

3 Credits

Examination and integration of basic processes for understanding individuals as dynamic biobehavioral complex systems functioning through continual interactions. BB H 503BB H 503 Biobehavioral Systems in Health and Development: Processes and Integration (3)Understanding the etiology of illness and the design of intervention strategies for promoting healthy development, preventing illness, and accomplishing remediation and rehabilitation require a multidisciplinary understanding of the theoretical basis of normal healthy human development and the complex biological processes that form the basis of health and development. This course is the second course in a two-course sequence (BB H 501 and BB H 503) that is designed to provide first-year graduate students with a multidisciplinary understanding of the biobehavioral health perspective. This views humans as complex dynamic systems of integrated component processes that interact with the environment to influence development and health. The first course (BB H 501) presents the theoretical framework of humans as complex dynamic systems, followed by modules on processes of cell biology and genetics as complex systems. This course (BB H 503) continues with modules of the processes of neurobiology, endocrinology, immunology, and pharmacology followed by a section on integrative biology and health. The modules of biological processes are developed from the perspective of how the physiological aspects of the area of biology are relevant to behavioral development and what aspect of this area of biology is linked to behavior. Similar integration with a primary emphasis on behavioral processes is offered in other courses that form the core graduate curriculum. These processes are considered in the context of their role in the comprehensive theoretical models developed in the first section of the two-course sequence. Evaluation of each of the five modules will be by written exam. This required course in the biobehavioral health sequence is designed to provide a multidisciplinary framework of theory and knowledge of biobehavioral processes and their implications for health and illness on which other biobehavioral health courses can build. It is the second of a two-course sequence (BB H 501 and BB H 503). This course will be required by all graduate majors in Biobehavioral Health. It will be available to students in other doctoral programs. It could be a part of a Biobehavioral Health minor for other students. This course will be offered every spring semester beginning with the first spring semester after approval and will enroll a maximum of twenty students. Faculty: George Vogler and Byron Jones

Prerequisite: or concurrent: BB H 501**BBH 504: Behavioral Health Intervention Strategies**

3 Credits

Evaluation of intervention strategies from a biobehavioral health context. Theories of change processes as they pertain to health are analyzed.

Prerequisite: BB H 502 , BB H 503**BBH 505: Behavioral Health Research Strategies**

3 Credits

Research strategies in behavioral health investigations are examined. Designs and data analytic models relevant to biobehavioral research are included.

Prerequisite: coursework in research design and/or introductory statistics**BBH 521: Structural Equation Modeling**

3 Credits

Structural Equation Modeling with LISREL and Amos. Confirmatory factor analysis; regression and path analysis with manifest/latent variables; special applications.

Prerequisite: HD FS519 , HD FS526**BBH 551: World Health Promotion**

3 Credits

Analysis of the various health problems that affect humans throughout the world; emphasis will be placed on personal health issues.

BBH 552: Child Maltreatment: Developmental Processes and Biological Embedding

3 Credits

The purpose of this course is to review the breadth of literature on the biological and developmental impact of child maltreatment including sexual abuse, physical abuse, and neglect on youth victims. Students will learn how to integrate child maltreatment research into a relevant, cohesive framework for understanding child maltreatment's wide-reaching effects. The biological focus of the course will be on the health consequences of child maltreatment as well as the neurological, neuroendocrine, and genetic embedding of child maltreatment. The course will also focus on the developmental antecedents and sequelae of child maltreatment through childhood, adolescence, and the transition to adulthood, including addressing how intergenerational transmission, parenting, interpersonal relationships, and attachment are associated with exposure to child maltreatment.

Cross-listed with: HDFS 552, PSY 552

BBH 553: Child Maltreatment: Policy, Administrative Data Systems, Prevention, and Treatment

3 Credits

The course will provide an overview of the major components of the child welfare system (e.g., child protection, family court, foster care, congregate care) involved in the community response to child maltreatment and promote a critical analysis of key federal policies that guide system activities. Course participants will also become familiar with Federal, state, and community data systems, and with methods to develop integrated data systems and their relevance to evaluating system outcomes and policy effects related to the child welfare system. Next, the course will give an overview of a range of experimental, quasi-experimental, and observational research designs and analytic methods relevant to evaluating the effects of child welfare policies and practices on child and family outcomes related to child maltreatment and system involvement. Finally, class participants will apply course content to develop applied research proposals that leverage administrative data for systems research and examine methods for communicating research findings to impact policy and practice at the community and federal levels. This course will also provide an in-depth examination of the major behavioral interventions, both preventive and treatment, applied with the child maltreatment population. Students will first be given an overview of the philosophy of science and experimental methods used to establish

behavioral interventions for child maltreatment. From there, students will review emerging paradigms within national funding agencies that focus on identifying and targeting mechanisms to optimize intervention effects.

Cross-listed with: HDFS 553, PSY 553

BBH 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

BBH 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

BBH 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

BBH 600: Thesis Research

1-15 Credits/Maximum of 999

NO DESCRIPTION.

BBH 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

NO DESCRIPTION.

BBH 602: Supervised Experience In College Teaching

1-3 Credits/Maximum of 3

NO DESCRIPTION.

BBH 610: Thesis Research Off-Campus

1-15 Credits/Maximum of 999

No description.

BBH 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

NO DESCRIPTION.

Bioch, Micrb and Molecular Biology (BMMB)

BMMB 502: Critical Scientific Analysis

2 Credits

In this course, students learn how to read and critically evaluate the scientific literature in biochemistry, microbiology, and molecular biology. Students will identify the hypotheses underlying each paper, and examine the experimental approaches and the rationale for the experimental

design, with particular focus on how a rigorous scientific argument is constructed. Students will also practice designing meaningful experiments and evaluating unpublished manuscripts.

BMMB 507: Seminar in Biochemistry, Microbiology, and Molecular Biology

2 Credits/Maximum of 4

No description.

BMMB 509: Ethics in Biomedical Science

1 Credits

Discussion of ethical issues relevant to scientific research in the biomedical sciences.

BMMB 511: Molecular Immunology

2 Credits

The study of molecular and biochemical events that influence immune responses and define current questions in immunology. BMMB 511 / MCIBS 511 / VBSC 511 Molecular Immunology (2) The goals of the course are to integrate the current questions of immunology with other disciplines, in particular cell biology and biochemistry, and to provide training in critical thinking and evaluation of data and experiments. The course will be approximately 2/3 lecture by the instructor and 1/3 student presentations of papers related to the material. In addition, written critical reviews of recently published papers and a short research proposal will be assigned. By focusing on the mechanisms involved in immunity and disease, this course complements several existing courses on immunology, virology, and biochemistry. The prerequisites of MICRB 410 and BMB 400 assure that the students enrolling in the course have a general understanding of immunology and biochemistry. This course is projected as an elective for the Molecular Medicine and Immunobiology focus areas in the MCIBS graduate program and for the Pathobiology and BMMB graduate programs. The course will be offered in the fall semester with an enrollment limit of 20 students

Prerequisite: B M B400 , MICRB410

Cross-listed with: MCIBS 511, VBSC 511

BMMB 521: Advanced Microbiology

3 Credits

This course presents graduate students in the life sciences with foundational concepts in the biology of microorganisms in the form of broad graduate-level lectures by research-active faculty and student presentations of related challenge problems/discussion subjects. The course is designed for graduate students studying microbiology, biochemistry, and other life science disciplines. The aim is to increase the students' knowledge and appreciation of diverse aspects of microbial physiology, ecology, pathogenesis, molecular biology, and genomics; to familiarize students with microbial faculty and their research at Penn State; to help students think critically about microbiological research methods, experimental design, and data interpretation; and to help students through participation and feedback to improve their oral and written communication skills in presenting scientific data to others.

BMMB 525: Analytical Separations

3 Credits

Fundamentals and applications of modern chromatographic separations.

Cross-listed with: CHEM 525

BMMB 531: Biomolecular Structure

2 Credits

Crystal structure determination and analysis of protein and nucleic acid three-dimensional structures. This course is taught in two parts. In the first part, students will learn the fundamentals of X-ray crystallography of bio-molecules. Topics covered include: What X-rays are and how to produce and use them safely, how protein crystals are grown, how X-rays interact with crystals to yield 3-dimensional diffraction data, how to solve a crystal structure and how to refine the structure. Basic mathematics and physics involved in this technique will be discussed. The students will also learn how to analyze a published crystal structure and how a crystallography laboratory works. The second part will focus on understanding how protein and DNA structure relate to the function of these macromolecules. The students will visualize macromolecular structures in class using videos and using interactive molecular graphics software on their own to develop an understanding of three-dimensional structures. Particular topics include: fundamentals of protein structure, enzymes, signal transduction molecules, immune molecules, protein-DNA interactions, and other related topics.

Prerequisite: BMB 401**BMMB 533: Protein Evolution**

2 Credits

Consequences of evolution of protein-coding sequences: structures and functions. BMMB 533 Protein Evolution (2) Most biological functions are carried out by proteins, and evolutionary logic can be used to infer functions. This course will focus on evolution of protein-coding sequences, conformations and functions of proteins. Different species show varying characteristics of structure, metabolism, and regulatory control networks. Most of these differences are the product of the evolution of protein-coding sequences. DNA mutations can change amino acid sequences, protein structures and protein functions; and favorable mutations are selected, in ways that are integrated to form an organism adapted at both macroscopic and molecular levels. The availability of large databanks of protein amino acid sequences, and protein three-dimensional structures, and the annotation of protein function in the entries in these databanks, has allowed investigation of evolutionary changes that impact proteins. One of the goals of the course will be to describe these databanks and the computational tools available to apply them in research in molecular biology. Many students will find these tools useful in their own research projects. The evolutionary divergence of proteins has shown several types of effects. In some cases, related proteins in different species retain similar functions, but show differences in amino acid sequence and structure. The nature of observed changes in sequence and structure will be described and the relationship between sequence changes and structural changes examined in several well-documented examples, including globins, and serine proteases. In some cases, proteins diverge within a single species to form large families of related molecules with specialized functions. For example, the human genome encodes hundreds of odorant receptors. The comparison of related proteins that have adopted novel

functions reveals how cells can expand their functional repertoire. In most cases it is easier to adapt an existing structure to a new function than to create a new protein "from scratch". For example, the proteolytic enzymes of the chymotrypsin family are related to haptoglobin, an iron scavenger that has lost its enzymatic activity. Beyond the description of individual proteins and individual protein families, there is the more general question of how changes in functions of individual proteins are integrated to create a smoothly-running cellular "operating system". The evolution of sequences encoding regulatory proteins to achieve this will be discussed. Methods of bioinformatics to address these questions will be presented, with emphasis on study and comparison of structures with computer graphics.

BMMB 536: Medicinal Chemistry and Chemical Biology

3 Credits

The goal of this course is to provide a foundation in development and application of chemical technologies to the understanding and manipulation of biological systems. Chemical biology is a relatively new field that spans the traditional fields of chemistry and biology by applying chemical technologies to the understanding and manipulation of biological systems. As such, this course should be accessible and provide benefit to students working in both chemical and biological areas. Lectures include higher-level biological chemistry (assuming prior knowledge of biological chemistry at an undergraduate level, such as CHEM 476 or BMB 401) and synthetic chemistry and biology principles along with current literature in the field of chemical biology.

Prerequisite: CHEM 476 or BMB 401

Cross-listed with: CHEM 536

BMMB 538: Spectroscopic Methods in Bioinorganic Chemistry

3 Credits

Foundations in spectroscopic methods employed for the determination of the geometric and electronic structure of transition metal clusters in nature.

Cross-listed with: CHEM 538

BMMB 539: Biochemical Reaction Mechanisms

3 Credits

Mechanisms of the most important biochemical reactions, with emphasis on enzyme catalysis.

Prerequisite: CHEM 476 or BMB 401

Cross-listed with: CHEM 539

BMMB 541: Molecular Biology of Animal Development

3 Credits

The course emphasizes comparative molecular genetic analyses of developmental gene networks using vertebrate and *Drosophila* model systems. BMMB 541 Molecular Biology of Animal Development (3) This is a required course for graduate students in the IBIOS Cell and Developmental Biology Program. Approximately half of the class sessions will consist of lectures and class discussions related to lecture material. The other half will consist of primary literature presentations by the students and class discussion pursuant to these. The course will provide students with a broad overview of essential signaling pathways and gene regulatory networks that coordinate cellular

activities to establish and maintain the complex communities of cells that comprise animal tissues.

BMMB 542: Eukaryotic Cell Biology

3 Credits

This course covers current areas of cell biology research, focusing on processes affecting the cell as a whole. BMMB 542 Eukaryotic Cell Biology (3) This course in eukaryotic cell biology will provide a foundation for those students whose thesis research focuses on cell biology or the cellular aspects of development. The primary focus will be to understand how the cell functions as a unit. Areas to be covered include compartmentalization of the cell and transport between different sub-cellular compartments; the control of cell shape and how cell shape and polarity changes drive cell movement and tissue shape; the life cycle of cells; and the regulation of these processes by extracellular signals. We will also investigate current research techniques and tools that are used to investigate these processes.

BMMB 543: Current Topics in Gene Regulation

3 Credits

This course explores structural, biochemical and genetic approaches in gene regulation. BMMB 543 Current Topics in Gene Regulation (3) This course is intended to bring students up to the leading edge of research in gene regulation. It will explore structural, biochemical and genetic approaches in this field of research, covering processes from nuclear structure to RNA decay. It will also illustrate progress from many different model organisms including: prokaryotes, yeast, Drosophila, and humans. This course will include introductory lectures by faculty and student presentations of recent literature.

Prerequisite: B M B400

BMMB 551: Genomics

3 Credits

This course will deal with the structure and function of genomes including the use of some current web-based tools and resources for studies and research in genomics. The overall objective is to learn current information about the structure and function of genomes, to develop facility in the many web-based tools and resources for further studies and research in genomics, and to appreciate the power and limitations of current resources and knowledge.

Cross-listed with: BGEN 551, MCIBS 551

BMMB 554: Foundations in Data Driven Life Sciences

3 Credits

Expanded overview of current developments and technique in computational biology and genomics. BMMB (MCIBS) 554 Foundations in Data Driven Life Sciences (3) The successful progression of data-driven biomedical research is obscured by a wide-range of logistical problems related to data handling and processing, a widespread disconnect between developers and consumers of biomedical analysis software, and lack of accessible, well-developed curricula and active learning opportunities necessary for the development of key data analysis skills in the next generation of researchers and clinicians. This course aims at filling these gaps. Topics include fundamental concepts that underpin analysis of sequence data, design of complex experiments, research

transparency and reproducibility, as well as result disseminations practices relevant to presentations and publications.

Cross-listed with: IBIOS 554, MCIBS 554

BMMB 566: Algorithms and Data Structures in Bioinformatics

3 Credits

This course covers elegant algorithmic and data structure techniques that underpin modern biological data analysis. Bioinformatics is a growing field with immediate implications for our understanding of biology and treatment of disease. This course covers elegant algorithmic and data structure techniques and their use in bioinformatics. The emphasis is on recurrent ideas that underpin modern biological data analysis, presented in conjunction with their biological applications. The course is suitable both for students interested in doing bioinformatics research and those interested in applications of algorithms to the natural sciences. Some of the algorithms/data-structures that may be covered include exact string matching, suffix trees, suffix arrays, de Bruijn graphs, hidden Markov models, breakpoint graphs, succinct data structures, the Burrows-Wheeler transform, the FM-index, network flow, and bidirected graphs. Some of the biological applications will include sequence alignment and assembly, cancer genomics, phylogeny, gene finding, and variation detection. No prior biological or bioinformatics knowledge is required. A basic understanding of data structures and algorithms (equivalent to CMPSC465) is a prerequisite; however, exceptionally motivated students can contact the instructor to discuss their options. This course is complementary to existing bioinformatics courses offered through other programs on campus. These courses may be taken concurrently but are not prerequisites. Prerequisites: CMPSC465 Cross Listings: BMMB 566 will be added as a cross-listed course.

Prerequisite: CMPSC465

Cross-listed with: CSE 566

BMMB 572: Nucleic Acids Chemistry

3 Credits

Biophysical and biochemical approaches for studying structure-function relationships in nucleic acids. BMMB (CHEM) 572 Nucleic Acids Chemistry (3) The goal of this course is to provide a foundation in biophysical approaches for studying the quantitative and structure-function relationships in nucleic acids systems, including DNA, RNA, and their interactions with proteins, salt, and water. Lectures include basic physical chemistry and statistical mechanics principles along with current literature in the biochemical sciences. At the end of the course, you should be able to meaningfully dissect molecular biological papers at the level of the physical chemistry of these processes. Current topics are introduced through reading and presenting papers from the literature.

Prerequisite: CHEM 212 , CHEM 450

Cross-listed with: CHEM 572

BMMB 573: NMR Spectroscopy for Synthetic and Biological Chemistry

3 Credits

Nuclear magnetic resonance approaches for characterizing the structure and dynamics of synthetic compounds, natural products, and biological macromolecules.

Prerequisite: CHEM 452

Cross-listed with: CHEM 573

BMMB 574: Metals in Biology: Structure and Mechanism

3 Credits

The goal of this course is to acquaint students with the many important roles that metal ions play in biological systems (bioinorganic chemistry). We will explore how structural biology, enzymology, spectroscopy, cell biology, and chemical biology methods have been used to understand how metal ions are used in biological molecules. These approaches have enabled discovery of the chemistry of these systems, and an understanding of how that chemistry fits into the broader biological context. We will apply bioinorganic chemistry in solving important challenges in energy, health, and the environment. Course activities include application of basic inorganic chemistry and biochemical principles, discussion of current literature in the biochemical sciences, implementation of biomolecular structure visualization software, and problem solving. At the end of the course, students will be able to critically engage with the bioinorganic literature and propose experimental approaches to unresolved questions in the field.

Prerequisite: CHEM 476 or BMB 401 Recommended Preparations: CHEM 412

Cross-listed with: CHEM 574

BMMB 581: Advances in Biochemistry

3 Credits

The course will develop a detailed molecular view of the building blocks of biological systems and a brief review of the structural and functional properties of these biomolecules. The course also will cover modern methods of biomolecule synthesis, purification, and modification. Subject matter will be approached using case studies highlighting techniques that allow us to gain a chemical understanding of biological processes. Examples include identification of drug binding sites, probing protein-protein interactions, targeting protein degradation, and modulating transcription. Important advances in our understanding of biological systems brought about by these techniques will also be discussed. Discussion of primary literature readings will include benefits/drawbacks of the various techniques, complementarity of methods, and the applicability of various aspects of chemical biology to dissect new problems.

BMMB 582: Advances in Genetics and Genomics

3 Credits

This course will develop a detailed view of genetic information, how it is stored and used by cells, and how it can be manipulated and analyzed to answer research questions. Both experimental and computational methods will be covered, with an emphasis on design and analysis of genetic, genomic, imaging, and dry-lab experiments.

BMMB 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

BMMB 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

BMMB 598: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

BMMB 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

BMMB 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

BMMB 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Teaching of biochemistry undergraduate laboratory and recitation classes under faculty supervision.

BMMB 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

BMMB 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

BMMB 801: Foundations of Teaching in Biochemistry, Microbiology, and Molecular Biology

1 Credits

An overview of the science of learning and teaching in biochemistry, microbiology, and molecular biology. This course is designed to prepare BMMB graduate students to become teachers and communicators, and specifically to prepare students to teach undergraduate students in labs or lecture courses. Students will explore how people learn, develop evidence-based teaching strategies to promote learning, and acquire confidence to create effective and inclusive classrooms.

BMMB 852: Applied Bioinformatics

2 Credits

This course provides a foundation for students with biology backgrounds in the computational analysis and interpretation of biological data. BMMB 852 Applied Bioinformatics (2) The purpose of this course is to provide students with a foundation in the various applications of high-throughput sequencing including: chip-Seq, RNA-Seq, SNP calling,

metagenomics, de-novo assembly and others. The course material will concentrate on presenting complete data analysis scenarios for each of these domains of applications and will introduce students to a wide variety of existing tools and techniques. By the end of the course work students will understand common bioinformatics data formats and standards, become familiar with the practice of analyzing sequencing data from various instruments and will develop the computationally oriented thinking that is necessary to take on large-scale data analysis projects.

Bioengineering (BIOE)

BIOE 501: Bioengineering Transport Phenomena

3 Credits

Application of the equations of mass, energy, and momentum conservation to physiological phenomena and to the design of artificial organs.

Cross-listed with: CHE 501

BIOE 503: Fluid Mechanics of Bioengineering Systems

3 Credits

Cardiovascular system and blood flow, non-Newtonian fluid description, vessel flows, unsteady flows and wave motion, windkessel theory, transmission line theory.

Prerequisite: BME 409 (equivalent to CHE 330, ME 320, or AERSP 308)

Cross-listed with: CHE 503

BIOE 505: Bioengineering Mechanics

3 Credits

Passive and active mechanical properties of tissues, rheological materials, models of muscle contraction, pulmonary mechanics, forces in muscular-skeletal system.

BIOE 506: Medical Imaging

3 Credits

Medical diagnostic imaging techniques, including generation and detection of ultrasound, x-ray, and nuclear radiation; instrumentation and biological effects.

Prerequisite: PHYS 202

BIOE 507: Technical Foundations in Functional Magnetic Resonance Imaging

3 Credits

Theory and applications of functional magnetic resonance imaging. The advent of new neuroimaging techniques such as functional magnetic resonance imaging (fMRI) has symbolized a new era of neuroscience. A large amount of neuroscience research today involves utilizing fMRI given its high spatial resolution and whole-brain coverage. In order to gain an in-depth understanding of these research findings, it is important to know the principles of fMRI. In this class we will address questions such as: What signal do different fMRI methods measure? How to interpret the results from different fMRI techniques? How to apply these methods to solving real neuroscience problems?

BIOE 508: Biomedical Materials

3 Credits

Properties and methods of producing metallic, ceramic, and polymeric materials used for biomedical applications. BIOE 508 BIOE (MATSC) 508 Biomedical Materials (3) The topical content of this course will be grouped into 4 areas. A general introduction to selected aspects of physiology will be presented. This will provide the background necessary to appreciate the factors which govern the selection of biomedical materials. Specific emphases will be placed on the polymerization of biopolymers (polypeptides and polysaccharides) and the general relationships between conformation and biological function, the biochemistry of blood and blood surface interactions, the formation of teeth and bone and the relationships between microstructure, composition and function, the immune responses to implanted materials, the resorption of bone (osteoporosis), and the development of caries. The perspective placed on these topics will be that of materials science. The selection of ceramics for hard tissue prosthesis will be described. Orthopaedic and dental applications for ceramics will be discussed. Specific ceramic materials to be treated include dental porcelain, alumina- and zirconia-based ceramics, and bioglasses. Various classes of inorganic cements, gypsum, zinc phosphates, zinc carboxylates, silicates, and glass-ionomer cements will also be considered as ceramics. Hydroxyapatite, HAP-based composites and HAP-metal interactions will be discussed in particular. Relationships among physical properties, mechanical properties, and chemical interactions with biological fluids will be described. Dental and orthopaedic applications of metals will be described. The fracture toughness of metals, their electrochemical responses in vivo, and the nature of the interfacial interactions with hard tissues will be treated. Dental amalgams and the noble metals for dental applications will be considered. Metals and alloys, such as Ti, Co-Cr, and stainless steel used in prosthetic applications will be described and their properties and limitations discussed. The phenomenon of stress shielding and the immune responses associated with the accumulation of metallic and polymeric particulate debris in the vicinity of an implant will be discussed in particular. Polymeric materials are important in a broad range of biomedical applications. Among these are soft tissue prostheses, hemostatic agents, dental restoratives, bone replacement materials, and surgical adhesives. In some applications, it is desirable that a polymeric material biodegrade while in others property retention is desirable. Because of the spectrum of applications for polymers, the topics to be covered will be limited with the intent to concentrate on hemocompatible polymers, acrylics used as bone cements, polyethylene used as bearing surfaces in prostheses, and dental resins and bonding materials. Other relevant polymers and their applications will be discussed.

Cross-listed with: MATSE 508

BIOE 509: Mechanobiology

3 Credits

This course explores the molecular bases of cell mechanics and the role of mechanics in cell biology

Prerequisite: BIOE 512 and BIOE 505

BIOE 510: Biomedical Applications of Microelectromechanical Systems (BioMEMS) and Bionanotechnology

3 Credits

Introduction to BioMEMS and Bionanotechnology. Topics include: electromechanical and chemical biosensors, microfluidics microscale separations, and surface patterning for cellular engineering. BIOE 510 BIOE 510 Biomedical Applications of Microelectromechanical Systems (BioMEMS) and Bionanotechnology (3) Microelectromechanical systems (MEMS) have been developed for a wide range of applications from automotive to medical devices. Nanoscale devices within MEMS have a particular usefulness in biological applications due to their small volumes, low energy sensing, and minimal force actuators. Increased efficacy of instruments and new areas of application are also emerging from specific and successful biomedical applications of MEMS (bioMEMS). Advanced development of nanotechnology and bioMEMS for biomedical and biotechnological applications requires basic foundations from biophysics, biochemistry, solid state devices, and polymer engineering. The objectives of this course are: to build a basic foundation for understanding of mechanisms on electrical, mechanical, chemical, and optical transducers in the context of biomedical applications; and, to teach critical thinking considering microengineering design and fabrication, material compatibility with biological systems, and cellular interaction at the interface. Finally current MEMS activities will be reviewed with emphasis on the examination of the viability of nanoscale devices and bioMEMS technology in particular biomedical applications.

Prerequisite: E E 441 , BME 201**BIOE 512: Cell and Molecular Bioengineering**

3 Credits

Graduate level cell and molecular biology course for engineers emphasizing molecular mechanisms. BIOE 512 BIOE 512 Cell and Molecular Bioengineering (3) This course investigates the molecules and mechanisms underlying cellular function from an engineering perspective, utilizing physical, chemical and quantitative approaches. Material covered includes the structure and chemistry of biological molecules, enzyme kinetics, DNA replication and repair, gene expression, recombinant DNA technology, subcellular organization, cell motility, signaling and cell division. Applications in medicine, biotechnology, bionanotechnology and tissue engineering are addressed. This is a lecture course graded by means of exams, homework assignments, and a final paper. A general knowledge of physics, chemistry, and some physiology is required; the analytical approach of the course will also require an ability to work with mathematical equations and simple models. It is geared towards engineering students and is also suitable for physics, chemistry, and materials science graduate students. Previous molecular and cell biology knowledge is not required. Three credits, generally offered each fall semester. No formal prerequisites.

BIOE 513: Bioengineering Laboratory Techniques

3 Credits

Laboratory techniques in cell molecular biology, protein biochemistry and cell culture with an emphasis on engineering analysis and quantification. BIOE 513 Bioengineering Laboratory Techniques (3) BIOE 513 is a three-credit laboratory course for engineering graduate students designed to introduce laboratory techniques used in bioengineering/biomedical research. The course objectives are to build a basic foundation for understanding biological assays in the context of biomedical engineering

applications and to introduce the student to the integration of biology with design and fabrication of devices. Consideration is also given to compatibility between biological systems and medical devices, and cellular interactions at the interface between biology and engineering. Emphasis is placed on cell and molecular biology, protein biochemistry, bacterial transformations, and mammalian cell culture with particular attention to engineering analysis and quantification. This course requires a substantial amount of laboratory work outside of designated meeting periods.

Prerequisite: BIOE 512**BIOE 514: Quantitative Microscopy**

3 Credits

Application of advanced microscopy to quantification of cellular and molecular function.

BIOE 515: Cell Mechanics and Biophysics

3 Credits

Advanced topics and recent developments in cellular engineering; applications of engineering science to cell biology.

Prerequisite: BIOE 505**BIOE 517: Biomaterials Surface Science**

3 Credits

Special properties of surfaces as an important causative and mediating agent in the biological response to materials. BIOE 517 BIOE 517. (MATSC 517) Biomaterials Surface Science (3) This course will factor the classical picture of the biological response to materials into spatial and temporal components, identifying the special properties of surfaces as an important causative and mediating agent. Emphasis will be on biophysical mechanisms and the biological response to materials. Contact activation of blood plasma coagulation cascade, bioadhesion, and protein adsorption will be repeatedly used as example biological response to materials surfaces to illustrate concepts and principles. Leading theories attempting to correlate both kinds of intensity of biological responses to surface and interfacial energetics will be compared and contrasted through a process that will quantify important surface thermodynamic properties of materials. The hydrophobic effect and related phenomena, especially as this pertains to water solvent effects in biology, will receive special emphasis. A general background in chemistry and/or biology is required, but prerequisites are purposefully limited, reflecting the interdisciplinary aspects of the subject and to draw students from different specializations.

Cross-listed with: MATSE 507

BIOE 518: Bioprinting

3 Credits

This course covers the principles of bioprinting in tissue engineering and regenerative medicine for use in fabrication of biomedical related products such as implants, tissue scaffolds, engineered tissues, organs and biological systems. Topics include Tissue Engineering, 3D Printing, Layered Manufacturing and Rapid Tooling in Medicine, Design for Bioprinting, The Bioink, Extrusion-based Bioprinting, Droplet-based Bioprinting, Laser-based Bioprinting, Bioprinters and their components,

Application Areas of Bioprinting and New Frontiers in Tissue Engineering such as Organ Printing.

Cross-listed with: ESC 518

BIOE 519: Artificial Organs Design

3 Credits

Basic techniques and principles of a multidiscipline approach to artificial organs design.

BIOE 552: Mechanics of the Musculoskeletal System

3 Credits

Structure and biomechanics of bone, cartilage, and skeletal muscle; dynamics and control of musculoskeletal system models. BIOE 552 BIOE (I E) 552Mechanics of the Musculoskeletal System (3)The course focuses on the upper limbs and its musculoskeletal components, including mechanical properties and models; work-related musculoskeletal injuries, techniques, models, and instruments to measure and quantify the risks for developing such injuries. Specific topics covered in the first third of the course include an introduction to basic biomechanical principles, the anatomical structure of the musculoskeletal system including soft tissue, neuromuscular physiology, and motor control including muscle receptors. The second third covers various muscle models starting from basic mass/spring/dashpot viscoelastic models as in Hill's 3-element model and continuing on to Hatzel's multi-element model, frequency analysis, control theory approaches. More complex models include static and dynamic aspects of tendon-pulley models and multiple muscle-tendon systems. The final third covers basic epidemiology as applied to musculoskeletal disorders and risk factors including instrumentation to measure them and various analysis tools (e.g., the PSU CTD Risk Index) to assess the not only the overall risk for injury but the reliability and validity of such assessments. Time permitting applications to hand tools and office environment with computer work stations are examined. Two exams and a modeling project are given. The course is typically offered Spring Semester.

Prerequisite: Consent of program. Prerequisite or concurrent: BIOL 472
Cross-listed with: IE 552

BIOE 553: Engineering of Human Work

3 Credits

Physics and physiology of humans at work; models of muscle strength, dynamic movements; neural control; physical work capacity; rest allocation.

Prerequisite: BIOL 141 or BIOL 472
Cross-listed with: IE 553

BIOE 576: Bioengineering of the Cardiovascular System

3 Credits

Experimental and analytical studies of network branching patterns, regional blood flow, rheology and mechanics of blood cells and vessels.

Prerequisite: BIOL 472

BIOE 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

Prerequisite: BME 590

Cross-listed with: BME 590

BIOE 591: Bioengineering Ethics and Professional Development

1 Credits/Maximum of 999

Problem solving methods in ethical decision making, best practices in research communication, and strategies for professional development. This course will cover the main philosophical underpinnings of bioengineering ethics. It will then assist in developing methods for ethical decision making in the main areas of bioengineering professional practice. These areas include data collection, management and presentation, animal and human experimentation, peer review and authorship, and social implications of bioengineering research. The course will then assist in the professional development of students by instruction in tools for effective acquisition of discipline-specific conceptual knowledge, research skill development, communication, management, leadership.

Cross-listed with: BME 591

BIOE 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

BIOE 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

BIOE 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

Bioethics (BIOET)

BIOET 501: Perspectives and Methods in Bioethics

3 Credits

This course explores a variety of theories and methods in bioethics and applies them to a selection of current topics.

BIOET 502: Perspectives in Macro-Bioethics

3 Credits

This course explores systemic and structural issues in bioethics, and the theories and methodologies required to address them.

Cross-listed with: PHIL 572

BIOET 504: Research Integrity in Science and Engineering

2 Credits

This course will examine the complex ways ethical issues are a component of research in science and engineering. BIOET 504 Research Integrity in Science and Engineering (2) Research Integrity in Science and Engineering provides a foundation for understanding an expanded conception of research ethics that includes traditional responsible conduct of research (RCR) issues, but encompasses two additional domains in which ethical issues are relevant to the conduct of science, namely, the broader impacts of science and ethical issues that are embedded in scientific practice. Students in this course will develop a robust understanding of ethical responsibility and ethics spotting in their professional work as well as pedagogical training to support their becoming research integrity leaders in their home disciplines. In this course, students will: understand and identify instances of embedded ethics, broader impacts, and research integrity as they apply to work within their profession; develop the ability to apply ethical reasoning skills to examples of each domain of research ethics through case-based analyses; and acquire pedagogical skills in research ethics through developing, delivering, and assessing curricular materials on relevant research ethics topics drawn from their home disciplines. Students will also develop a research ethics teaching portfolio and will be encouraged to work with their departments to identify ways to develop peer mentoring on these important topics.

BIOET 531: Neuroethics: Science, Technology, and Society

3 Credits

This course provides a close examination into the field of neuroethics and the responsible application of advances in neuroscience research and neuroengineering. Neuroethics is a relatively young and interdisciplinary field of inquiry that aims to be a platform for different stakeholders, including neuroscientists, clinicians, lawyers, engineers, policy makers and the general public to discuss the future of neuroscience and the different applications of neurotechnologies. Neuroethics is a field that brings normative, descriptive, theoretical and practical considerations at the table. This course will cover topics such as different perspectives on neuroethics, its scope and role in recent brain initiatives, ethical and societal implications of brain imaging for medical and non-medical purposes, ethical and societal implications of the use of pharmacological and neuromodulation interventions on the brain, uses of neuromodifiers for enhancement purposes, issues around personhood and other emerging topics relevant to neuroethics. Among the ethical issues examined in the course are issues related to mental privacy, safety considerations, responsibility, agency, and social justice.

Recommended Preparation: An understanding of ethics, societal implications of technology, and neuroscience or neurotechnology background. Courses in functional and integrative neuroscience, as well as courses that provide a grounding in bioethics
Cross-listed with: ESC 531, NEURO 531

BIOET 533: Ethical Dimensions of Renewable Energy and Sustainability Systems

3 Credits

BIOET 533 will provide students with an understanding of the ethical dimensions of renewable energy and sustainability systems and with skills to analyze related case studies. Case studies that will be considered are grounded in topics relevant to the sourcing and

generation of energy across political-economic development contexts, including the use of sustainability indicators. Energy related topics include everything from traditional fossil fuels to renewables such as wind, solar, and biofuels. Students study responsible conduct of research (RCR) and professional ethics, in the commercial and academic context of applications in the area of renewable energy and sustainability systems, as well as examine the ethical dimensions of broader public and environmental impacts, and embedded values in research and analysis in this field. The course will provide for ethical analyses of knowledge generation and communication issues such as: selection of research questions; selection of datasets and parameters; determination of system boundaries; procedural considerations in decision making processes; methods of analysis; risk assessments and communication; influence of scientific research on policy outcomes; and, how to critically evaluate the use of scientific evidence and expertise when making and communicating arguments. Some lessons/modules will focus more on ethical issues encountered in practice, while other modules will provide examples that will impact overall ethical literacy and awareness of social and ethical impacts relevant to renewable energy and sustainability systems research and its numerous applications.

BIOET 540: Bioethics, Biopower, Biopolitics

3 Credits/Maximum of 999

This course will examine in a bioethical context a variety of ways relations of power and values intersect. Bioethics, Biopower, and Biopolitics will develop an understanding of bioethics by considering the ways people's lives interconnect and the relations of power that infuse and often control these interconnections. The goal is to expand the use of the term "bioethics" beyond the scope of medical practice and institutions and to bring it to bear on a much wider scope of life. We will consider options for understanding the meaning of "bioethics" by reference to the interplay of values and relations of power that more or less enhance human lives by the practices and policies that form, control, or liberate them.

BIOET 590: Bioethics Colloquium

1-3 Credits/Maximum of 36

Continuing seminars in bioethics that consist of a series of individual presentations by faculty, students, or outside speakers.

BIOET 594: Research Topics

1-12 Credits/Maximum of 15

Supervised student activities on research projects identified on an individual or small-group basis.

BIOET 595: Internship

1-12 Credits/Maximum of 12

Supervised off-campus, nongroup instruction, including field experiences, practicums, or internships related to bioethics.

BIOET 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

BIOET 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given infrequently to explore a topic or topics in bioethics in depth.

BIOET 600: Thesis Research

1-15 Credits/Maximum of 999

Thesis Research in Bioethics.

BIOET 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Students will teach lower-level undergraduate courses in bioethics, including courses on the undergraduate minor in bioethics and medical humanities.

Bioinformatics and Genomics (BGEN)

BGEN 541: Critical Analysis of Bioinformatics and Genomics Research Topics

3 Credits

Critical Analysis of Bioinformatics and Genomics Research Topics reviews the recent developments made in the understanding of basic genomics and bioinformatics research. This approach provides an insight into the topics that are shaping the current and future directions in a field that is rapidly evolving and literally transforming lives. Tutorials provide a comprehensive overview of the new and fundamental developments in genomics research and highlight the way in which genomic concepts are applied to basic biological processes. This course will provide insights into computational, evolutionary, and functional aspects of genomic sciences. Basic concepts that describe how life was organized and evolved and applications that promise huge advances in biomedical and biotechnological fields will be discussed. In addition to helping students develop critical oral and written presentation skills, this course is intended to kindle excitement about genomic research among students and provide an intellectual framework for identifying potentially challenging and interesting questions that may be pursued.

BGEN 551: Genomics

3 Credits

This course will deal with the structure and function of genomes including the use of some current web-based tools and resources for studies and research in genomics. The overall objective is to learn current information about the structure and function of genomes, to develop facility in the many web-based tools and resources for further studies and research in genomics, and to appreciate the power and limitations of current resources and knowledge.

Cross-listed with: BMMB 551, MCIBS 551

BGEN 556: Computation, Bioinformatics, and Statistics Practicum

3 Credits/Maximum of 999

Students will identify, plan and implement actual research projects involving high dimensional, complex "omics" data that are relevant to the biomedical sciences and of direct interest to the students enrolled

and their mentors. Students will form teams and work on these projects throughout the semester, fostering interdisciplinary exchanges, the ability to work collaboratively in teams, and excellence in oral and written communication. Various types of computational tools and statistical techniques will be discussed, utilized and compared, based on students' background and choice of research projects.

Prerequisite: MCIBS 541

BGEN 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

BGEN 595: Internship

1-18 Credits/Maximum of 18

Supervised, research-oriented, off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

BGEN 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

BGEN 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

BGEN 600: Thesis Research

1-15 Credits/Maximum of 999

Thesis Research

BGEN 601: Thesis Dissertation Full-Time

0 Credits/Maximum of 999

Thesis Dissertation Full-Time

BGEN 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Supervised experience in teaching and orientation to other selected aspects of the profession at The Pennsylvania State University.

BGEN 611: PhD Dissertation Part-Time

0 Credits/Maximum of 999

PhD Dissertation Part-Time

Biological Chemistry - MD (BCHEM)

BCHEM 510: Carcinogenesis and Chemoprevention

2 Credits

Mechanisms of cancer induction by environmental carcinogens and chemoprevention by natural and synthetic agents. BCHEM 510 BCHEM 510 Carcinogenesis and Chemoprevention (2) The etiology of most human cancer remains obscure even though a vast body of literature describes risk factors for certain cancers and proposes various hypotheses for cancer etiology on the basis of epidemiological and experimental studies. Tobacco smoking is an established cause of several cancers, with lung cancer remaining the first target on the list. International studies have repeatedly confirmed that people (Chinese, Japanese) migrate from their country of origin to the U.S., adopt the pattern of certain cancers within a few generations (e.g., breast and prostate) of the latter country, which is indicative of the presence of chemical carcinogens in the environment and/or changes in lifestyles. Consequently, the search for carcinogens that exist in the human environment challenges both scientists and regulatory agencies. Chronic exposure to traces of chemical carcinogens in the diet, in polluted air, or in tobacco smoke can be important in the etiology of several human cancers in the presence of host factors that favor the multi-step process of carcinogenesis. Bioassays in laboratory animals can provide important information on the role of environmental agents in the induction of particular types of cancer. Biochemical studies can lead to insights into the nature of interactions of these environmental agents with macromolecules such as DNA that are necessary, but not always sufficient for carcinogenesis. The search for optimal diets and for naturally occurring agents in routinely consumed foods that may inhibit cancer development, although challenging, constitutes a valuable and plausible approach to finding ways to control and prevent cancer. The prevention of cancer is the longstanding goal for most cancer researchers. There has been enormous gain in our understanding of carcinogenesis and cancer progression; such knowledge has provided new and promising opportunities to prevent cancer, e.g., to treat pre-cancer or inhibit carcinogenesis (a process often involving 20-30 years in human epithelial cancers), rather than waiting to treat cancer. In the early 1980's, the U.S. National Cancer Institute recognized the promise of chemoprevention research. In summary, this course will provide a better understanding of the potential contribution of environmental carcinogens in the development of certain human cancers and will provide important information on cancer chemoprevention intervention strategies. The course will cover topics that include exposure, metabolic activation, detoxification, and biomonitoring of chemical carcinogens in the human environment, carcinogen-induced DNA damage, mutagenesis and DNA repair, carcinogen-induced cellular and molecular alterations, tumorigenesis and organ specificity in laboratory animals, and factors modulating individual susceptibility to the deleterious effects on chemical carcinogens. Furthermore, this course will provide knowledge on various classes of cancer chemopreventive agents, their efficacy, safety, and mechanisms of action in preclinical studies. Course Objectives: Upon completion of this course, the students will be able to: 1. Understand the potential risk associated with human exposure to chemical carcinogens detected in the environment. 2. Describe the current assays of biomonitoring of human exposure to chemical carcinogens. 3. Learn the process of metabolic activation and detoxification of chemical carcinogens. 4. Understand the stages of the multi-step carcinogenesis process. 5. Identify factors that govern individual susceptibility to the deleterious effects of chemical carcinogens. 6. Understand the concept of cancer chemoprevention. 7.

Identify molecular and cellular targets for chemoprevention intervention at any time during the process of carcinogenesis. Grading: Grading will be determined as follows: 1. Midterm Exam 30% 2. Research Paper* 30% 3. Class Participation 10% 4. Final Exam 30% Total 100%*Guidelines for Research Paper: The topic will be selected following approval of the faculty member in charge. The paper should include the goals (aims) of the research project, literature background, the significance of the research topic, knowledge to be gained, gaps in existing knowledge, and the potential to propose future studies. Faculty Member Proposing: Karam El-Bayoumy

BCHEM 521: Biochemistry: Structure/Function/Regulation of Biological Molecules

3 Credits

The fundamentals of biochemistry in evaluating the forces that govern inter- and intra-molecular interactions are studied. BCHEM 521 Biochemistry: Structure/Function/Regulation of Biological Molecules (3) An overriding theme in biochemistry is that macromolecules, which are polymers of simpler molecules, interact to form structurally large and functionally complex entities that give rise to discrete structures and functions. This course focuses on intermolecular forces between the monomers of macromolecules that govern tertiary structure, as well as interactions between macromolecules that govern higher order structures. The course begins with proteins, covering the structural basis of protein functions and then moves on to simple enzyme kinetics and mechanisms. Next, the students will discover the forces that control the three dimensional structures of nucleic acids. Subsequently, the students will explore simple and complex carbohydrates and topics in glycobiology that include energy storage, framework skeleton, and specific molecular recognition. Lipid biochemistry will be examined next, in topics that include lipid chemistry, complex lipids, membrane biology, and transport systems. Finally, the analysis of higher order structures involving the interactions between protein, nucleic acids, lipids, and carbohydrates will be discussed. The course will describe various analytical, chemical, and biochemical techniques that biochemists use to interrogate biomolecular structure and interactions.

Prerequisite: BMS 501 , BMS 502 , BMS 503

BCHEM 522: Molecular Genetics: Genes to Genomes

3 Credits

This course focuses on concepts of molecular genetics and genomics, and DNA- protein interactions and their functions within macromolecular complexes. BCHEM 522 Molecular Genetics: Genes to Genomes (3) This course focuses on the principles and concepts of molecular genetics and genomics and DNA-protein interactions and their functions within macromolecular complexes. Special emphasis is placed on the aspects of eukaryotic genome organization, chromatin and chromosome structural and epigenetic changes, and DNA-protein interactions that regulate expression of genetic information and change the process of inheritance in normal and disease models and affect genome stability. This course contains three major sections. Section I includes principles of recombinant DNA technologies used in the analysis of DNA sequences and genome structure. Section II covers genetic interactions and macromolecular assembly and provides links between the studies of molecular interactions and equilibrium with in vivo and genetic approaches. Section III covers genome stability, epigenetics, and medical applications involving mis-regulation of the molecular mechanisms involved in these processes. This part builds on material presented in the BMS 503 course of the core curriculum and provides students an in-depth

understanding of the molecular mechanisms of genome alterations and their biomedical significance.

Prerequisite: BMS 501 , BMS 502 , BMS 503

BCHEM 581: Enzymology: Structure, Energetics, and Function-A. Structural Biology

1 Credits

Structural biology: NMR spectroscopy and X-ray crystallography. BCHEM 581 BCHEM 581 Enzymology: Structure, Energetics, and Function-A. Structural Biology (1) The objectives of this course are to provide students with a solid background to critically interpret X-ray crystallographic and NMR experiments. Topics will be covered in the X-ray crystallography lectures will include crystal growth, diffraction, phasing and refinement to determine the structure. Topics in NMR spectroscopy will include basic principles, multidimensional experiments, and assignments of atoms to resonances, structure determination and dynamics of ligand binding to proteins. The students will learn the basic principles of protein structure determination by NMR and X-ray crystallography.

BCHEM 582: Enzymology: Structure, Energetics, and Function-B. Practical Enzymology

1 Credits

Practical aspects to study protein-ligand binding and substrate-enzyme reaction. BCHEM 582 BCHEM 582 Enzymology: Structure, Energetics, and Function-B: Practical Enzymology (1) The objectives of this course are to provide students with a solid background in practical enzymology.

BCHEM 583: Enzymology: Structure, Energetics, and Function-C. Mechanisms of Enzyme Reactions

1 Credits

Molecular basis for enzyme specificity and catalysis. BCHEM 583 BCHEM 583 Enzymology: Structure, Energetics, and Function - C. Mechanisms of Enzyme Reactions (1) The objectives of this course are to provide students with the wherewithal to interpret and design experiments aimed at elucidating the mechanisms of enzyme catalyzed reactions. Selected mechanisms of enzyme catalyzed reactions will be surveyed using primary literature. The rationale for the chemical, kinetic, molecular biological, spectrophotometric, thermodynamic tools that are used to investigate these reactions will be discussed. Topics that will be discussed include (a) principles of enzyme catalysis, (b) electrostatic catalysis (c) acid/base catalysis, (d) phosphates (e) Schiff base formation. Cofactors that will be discussed include pyridyl pyrophosphate, thiamine, biotin, tetrahydrofolate, NAD, FAD, S-adenoxyl methionine, and vitamin K and B12.

BCHEM 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

BCHEM 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

BCHEM 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

BCHEM 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

BCHEM 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

BCHEM 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

Biology (BIOL)

BIOL 503: Critical Elements of Genetics and Molecular and Cellular Biology

4 Credits

Foundational topics and critical analysis in evolution, genetics, molecular and cellular biology and cell differentiation. BIOL (/BMMB/MCIBS/ VB SC) 503 Critical Elements of Genetics and Molecular and Cellular Biology (4) Central elements in genetics, genomics and molecular and cell biology will be covered. The course will focus on foundational principles and concepts that will allow students to understand the behavior of proteins and organelles within cells, and to appreciate how intracellular events influence interactions of cells with one another in multicellular systems and during development. Another major focus will be genome architecture, both in the context of evolution and gene expression. Students will also learn how genetic approaches can be used to understand cell and molecular biology, and will develop critical thinking skills through the analysis of the primary scientific literature. The course will include lecture and discussion sessions.

Cross-listed with: MCIBS 503, VBSC 503

BIOL 514: Topics in Systematics and Evolution

2 Credits

Discussion of pertinent current literature in systematic biology and evolution.

BIOL 519: Ecological and Environmental Problem Solving

4 Credits

Overview of processes involved in solving environmental problems. Provides students with toolkit for understanding ecological and environmental problems. Untitled Document BIOL 519 Ecological and Environmental Problem Solving (4) The course will provide a general overview of the process involved in studying a variety of ecological and environmental problems. It will provide a toolbox of techniques for understanding ecological and environmental problems, and discuss how they can be used to address questions and generate testable predictions. It will examine connections between individuals and populations and communities as well as between theory and data. The focus will be on theoretical and computer modeling approaches, while maintaining a strong link to data and real systems. After an introduction to modeling, students will learn to develop and use simple and stochastic optimization models for individual organisms, as well as applying basic game theory to interactions between individuals. Many of the class meetings will be held in computer laboratories where they will be actively engaged in working on applying these models. They will explore a sequence of population demographic models of increasing complexity, ranging from unlimited unstructured population growth to density-dependent, structured population growth, in non-spatial and spatial contexts, culminating an individual-based models for population dynamics. The students will then apply these models to interacting species, learning about mutualistic, competitive and host-natural enemy interactions. Finally, we will explore theory for communities of species in space and time. Applied problems will be drawn from all areas of conservation, harvesting, pest control and epidemiology. Graduate students will additionally be required to attend a once a week case study, where we will focus on a paper from the recent literature that uses the techniques or theory learned that week in class. Additionally, graduates will develop models of their own, based on their own research, or on some other subject of interest. They will be expected to meet with me twice in a group and individually during office hours throughout the semester, to discuss the development of their projects. They will have to complete a written report on the motivation, model development, and results and implications of their work. This work will take the form of a short manuscript (as if for publication to a representative journal in their field). They will also have to make a verbal presentation to the entire class on their project (15 minutes, as if attending a professional conference). The course will be offered once/year.

Prerequisite: BIOL 220 or an introductory ecology course

BIOL 555: Statistical Analysis of Genomics Data

3 Credits

Statistical Analysis of High Throughput Biology Experiments.

Cross-listed with: MCIBS 555, STAT 555

BIOL 559: Charles Darwin's On the Origin of Species

3 Credits

Each week will be dedicated to one chapter of the first edition (1859) of Charles Darwin's masterpiece On the Origin of Species. Each chapter is divided by Darwin himself in a series of sections (usually about 10 sections per chapter). Each chapter will be commented on through an open discussion which will proceed section by section. The main goal of the open discussion will be to extract from each section the main

argument(s) presented by Darwin. During the open discussion, the instructor will give students an overview of the historical background: ideas and knowledge at the time; each person cited by Darwin will be commented on; Darwin also sometimes refers to other people's findings or ideas without citing their names, and those will be revealed and commented on too. We will critically discuss the data that Darwin mentions, whether they are from his own observations or not. We will also pay special attention to his writing style (vocabulary, repetitions, etc.) which is very precise. Occasionally, changes that Darwin made in the later editions will also be highlighted (using the variorum edition). At the end of this course, students will be able to use a rigorous method to critically study any important work in history of science (by putting any text within its own historical, cultural, and scientific context). The students will understand in depth Darwin's remarkable achievement in On the Origin of Species, which will allow them to take it back to their classrooms with undergraduate students as well as apply it to their own research. Students will be able to make direct connections between Darwin's masterpiece and modern biology because Darwin touched upon many of the questions that we are still struggling with. After this course, students will be able to realize that vocabulary, rhetoric, and writing style do matter, because On the Origin of Species is a masterpiece of scientific communication, and apply that to their own scientific writing.

BIOL 571: Integrative and Cellular Mammalian Physiology I

3 Credits

Mammalian cardiovascular, respiratory, renal, and gastrointestinal systems. This course in Cellular and Integrative Mammalian Physiology covers all major aspects of physiology. A special emphasis will be placed on how cellular aspects of physiology are integrated with organ and systems physiology. It is designed for students that either major in Physiology or are interested in integrating physiology concepts into their education. An in depth presentation of membrane biophysics, muscle dynamics, cardiovascular and circulatory regulation, respiratory and renal function, as well as acid base balance are addressed.

Prerequisite: BIOL 472

Cross-listed with: PHSIO 571

BIOL 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

BIOL 591: Molecular Evolutionary Biology Seminar

1 Credits

Continuing seminars in Molecular Evolutionary Biology consisting of individual lectures by faculty, students, or outside speakers.

BIOL 592: Critical Evaluation of Literature in Biology

1 Credits

Weekly readings and critiques of recent papers from primary literature are used to teach independent thinking and effective scientific communication. BIOL 592 BIOL 592 Critical Evaluation of Literature in Biology (1) This course teaches beginning graduate students how to evaluate new findings reported in primary literature in the biological sciences. Each week, a recently published paper is evaluated according to 8 basic criteria as follows: 1. Does the author adequately establish a

context for the issues addressed in the paper? Are the issues addressed in the paper important in the field? Why or why not? 2. What is the hypothesis? Is it clearly stated? Is it operational (i.e. "falsifiable")? 3. Are the methods adequate to test the hypothesis? Why or why not? What are the controls? Are they adequate? 4. Are the data clearly presented? Are the results properly analyzed? Are statistical inferences stated appropriately? Do the data meet the assumptions of the statistical tests? 5. What conclusions are drawn from the results? Do the conclusions follow from the data? Have some conclusions been overlooked? Are there reasonable alternative interpretations of the data? Did the authors consider alternative hypotheses? 6. What could be done to improve the paper? Consider written format as well as the overall experimental design. For example, is the title appropriate? Does the abstract accurately summarize the results and conclusions? Does the paper use recent and appropriate references? 7. What is your overall opinion of the size of contribution that the paper makes to the body of knowledge in its field? Is this work creative? Does it provide new insights or a framework to understand previously disparate data? Defend your position. 8. What would be the next set of tests of the hypothesis or the next hypotheses to test? How should these hypotheses be examined experimentally? To what extent do you think this paper will stimulate further studies? The goal of the course is to provide students with opportunities to sharpen their thinking in regard to what constitutes meaningful scientific experimentation, interpretation of results, and effective presentation of information in text, figures, and tables. Near the end of the course each student prepares a written critique of a paper, and meets individually with the faculty to discuss their critique. The course follows a format very similar to the Ph.D. candidacy exam for Biology, thus providing formal preparation for that exam. Faculty: James Marden

Prerequisite: Departmentally controlled

BIOL 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on and individual basis and which fall outside the scope of formal courses.

BIOL 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

BIOL 598: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

BIOL 598B: **SPECIAL TOPICS**

1-3 Credits

BIOL 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

BIOL 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

BIOL 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 3

Supervised experience in teaching and orientation to other selected aspects of the profession at The Pennsylvania State University.

BIOL 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

BIOL 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

BIOL 893: Experiential Teaching in Biology

2 Credits

The course provides a broad exploration of the science of learning as well as how to effectively develop curricula and pedagogy to support effective learning in undergraduate biology laboratory courses. Additionally, this course will prepare graduate students for future roles as educators. In particular, this course will focus on the cognitive principles of how people learn most effectively as well as provide students the skills involved in developing curricula and pedagogy to support active learning and a learner-centered environment in undergraduate biology laboratory courses. The major topics to be covered include the science of learning, the need for curricular reform in the sciences, how to create a student-centered learning environment, and the ethical and professional foundations of teaching. After successfully completing this course, students will be able to use evidence to discuss the value of learner-centered classrooms in the sciences, identify elements of a learner-centered biology classroom, identify major classroom challenges and methods of approaching them, write effective assessment questions and provide effective feedback to students, lead productive and effective class discussions, and demonstrate understanding of how people learn and apply learner-centered teaching approaches to developing effective lesson plans.

Biomedical Engineering (BME)

BME 504: Numerical Methods for Chemists and Engineers

3 Credits

CHEM 504 is a 3-credit course designed to give graduate students an overview of basic numerical techniques. After completion of the course, the students will be able to perform simple computational tasks. The emphasis will be given to numerical solutions of ordinary and partial differential equations relevant to the chemical and biomedical research, such as reaction kinetics and transport phenomena. This 500-level course will contribute to the student's ability to expand the frontiers of knowledge, to perform independent research, work as a team, and make conference-style presentations.

Recommended Preparations: Working knowledge of calculus and familiarity with Matlab.

Cross-listed with: CHEM 504

BME 540: Biophysical Chemistry

3 Credits

This three-credit course will cover the key theories and experimental methods of contemporary biophysics and biophysical chemistry. The course discusses the structures and dynamics of biomolecules (such as proteins, DNAs, and RNAs), the statistical mechanical models to describe the behaviors of biopolymers and the biophysical methods to analyze the structures of biopolymers in solution, the biophysical theories for protein folding/unfolding and the experimental methods to measure the kinetics of protein folding/unfolding and the protein structural dynamics, the principles of biomolecule structure determination by X-ray crystallography and cryogenic electron microscopy, and fluorescence microscopes, as well as the theories to describe ligand binding to biological macromolecules (such as receptors, protein complexes, aptamers, etc.) and the experimental methods to measure ligand binding. For all the topics covered by this course, emphasis will be laid on both theoretical models and experimental methods will be discussed. Classic and modern biophysical and biochemical techniques ranging from spectroscopy and FRET to optical microscopy, including super-resolution and micromanipulation techniques, will be covered. Applications of these biophysical techniques will also be discussed.

Prerequisite: CHEM 450

Cross-listed with: CHEM 540

BME 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

Prerequisite: BME 590

Cross-listed with: BIOE 590

BME 591: Bioengineering Ethics and Professional Development

1 Credits/Maximum of 999

Problem solving methods in ethical decision making, best practices in research communication, and strategies for professional development. This course will cover the main philosophical underpinnings of bioengineering ethics. It will then assist in developing methods for ethical decision making in the main areas of bioengineering professional practice. These areas include data collection, management and presentation, animal and human experimentation, peer review and authorship, and social implications of bioengineering research. The course will then assist in the professional development of students by instruction in tools for effective acquisition of discipline-specific conceptual knowledge, research skill development, communication, management, leadership.

Cross-listed with: BIOE 591

BME 594: Research Topics

1-3 Credits/Maximum of 6

Supervised student activities on research projects identified on an individual or small-group basis.

BME 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

BME 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

Biomedical Sciences - MD (BMS)

BMS 500: Foundations of Biomedical Research

4 Credits/Maximum of 999

This hands-on course teaches students a variety of fundamental skills required to successfully conduct independent biomedical research. The goals of this course include early exposure to important basic biomedical laboratory techniques and developing both written and oral scientific communication skills, with the broader goals of creating a sustainable peer group and fostering rapport with faculty members. The course will be 4 weeks in duration, and consist of hands-on laboratory time, daily literature discussions, a final written report documenting experimental results and data interpretation, and a journal club-style oral presentation. The first week of the course is spent on fundamentals such as searching the literature, using citation indexes, notebooking and basic analytical techniques, as well as exposure to databases manipulating nucleic acid and protein sequences with the goal of enhancing understanding of the experimentation performed in the following 3 weeks of the course. Weeks 2-4 are designed to include an authentic research experience. Rather than having all reagents ready for the students, it is more valuable to perform experiments in "real time." The experimental design consists of the following: 1. Students will purify and identify unknown plasmids by restriction digestion based on plasmid maps created with available software. 2. Students will design and execute a transient transfection with proper controls, and assess the expression of both the plasmids of interest by PCR and their protein products by Western blot analysis. 3. Students will predict which downstream pathways will be altered based on their reading of the primary literature, and assess expression of proteins of interest. Each day will consist of lab assignments and presentations/discussion based on the current scientific literature. This will allow students to develop their own hypotheses that they can then test in a laboratory setting. The course will culminate in an independent report describing the experimental strategies, outcomes, interpretations, and alternative/subsequent hypotheses derived from the lab experience. Students will also give an oral presentation of an article reflecting their own research interests, which will be chosen and prepared in consultation with a faculty advisor.

BMS 501: Regulation of Cellular & Systemic Energy Metabolism

3 Credits

Teaches biochemical and signal transduction concepts while exploring the control of bioenergetic processes. BMS 501 Regulations of Cellular & Systemic Energy Metabolism (3) Energy is fundamental to life. The production, storage and utilization of energy by organisms are highly regulated processes that provide excellent examples of the principals that govern the control of cellular metabolism and hormonal signaling. In addition, future biomedical scientists must be prepared to study diseases associated with aberrant energy metabolism, such as diabetes, obesity, and malnutrition. Regulation of Cellular & Systemic Energy Metabolism is one of three thematic courses that comprise the fall semester. The course explores how energy is obtained, stored and utilized by cells, tissues and organisms. The biochemistry of energy metabolism is studied with a focus on mechanisms by which these pathways are controlled in order to maintain health and energy homeostasis. Principles of hormonal signaling and cellular signal transduction pathways are studied in the context of energy metabolism. In addition, knowledge of these subjects is applied to the study of pathologies involving abnormal energy metabolism, including diabetes, obesity and starvation. Course objectives include developing an understanding of metabolic pathways and the mechanisms by which they are regulated; understanding principals of receptor theory, signal transduction and hormonal control of cellular processes; and gaining an understanding and appreciation of diseases that involve abnormal energy metabolism. The course is taught in approximately four blocks, with review sessions and examinations following each block. Exams are designed to determine mastery of the subject matter and to evaluate the ability to solve problems and logically address research questions. The principles and skills learned through successful completion of the course help prepare students for advanced graduate courses and graduate research careers.

BMS 502: Cell and Systems Biology

3 Credits

Explores the cellular and intracellular organization of biology, assembly of cells into tissues, and further integration into biological systems. BMS 502 Cell and Systems Biology (3) This course will cover the cellular basis of physiological processes from a systemic perspective. The major emphasis will focus on the cellular, molecular, and biochemical basis of normal and abnormal (pathological) tissue function. A special emphasis will be placed on common themes applicable to all tissue and the integration of molecular, cellular, tissue and organ systems. Introductory lectures will be followed by discussion of the primary literature that complements the lecture material. The course is designed to give students an appreciation of the cell and molecular mechanism underlying physiological processes as well as cell and molecular biology research techniques.

BMS 503: Flow of Cellular Information

3 Credits

Teaches concepts underlying the inheritance, transmission and translation of genetic information. BMS 503 Flow of Cellular Information (3) Medicine in the 21st century must incorporate an understanding of the genetic information that underlies all biological processes in every cell, tissue, and organism together with an appreciation of how genetic differences impact complex cellular pathways and individual traits or disorders. Further, with the culmination of the human genome project and high-throughput analysis this

information can now be considered in the context of whole genomes and proteomes. This course provides students with a fundamental understanding of the basic processes that convert this genetic DNA information to produce RNA and proteins and the genetic principals that underlie transmission of this information at each cell division and to subsequent generations. This topic is of importance for all biomedical disciplines. The course explores how DNA is inherited, replicated, transcribed, translated, mutated, repaired, and manipulated, and how this information is utilized by cells, tissues and organisms and in the context of genomes and populations. Central dogma (DNA to protein) is studied with a focus on mechanisms by which these processes are controlled. Other topics include non-coding RNAs and protein degradation. Course objectives include understanding the mechanisms of how these processes occur and how they are regulated; developing an appreciation for the genetic and molecular biology approaches that have allowed insight into these processes. The flow of cellular information is one of three thematic courses that comprise the fall semester. The course is taught in approximately three blocks, with review sessions and examinations following each block. Exams are designed to determine mastery of the subject matter and to evaluate the ability to solve problems and logically address research questions. The principles and skills learned through successful completion of the course help prepare students for advanced graduate courses and graduate research careers.

BMS 504: Art of Scientific Communication I

1 Credits

Introduction to scientific analysis, writing, and oral presentation using primary literature sources. BMS 504 Art of Scientific Communication I (1) The overall goal of BMS 504, and the sequential course BMS505 taken in the Spring semester, is to develop the students into scientific communicators who, in written and oral formats, can convey scientific concepts and the experimental support for these concepts. This includes the development of the knowledge base and communication skills required for effective scientific exchange and engagement. BMS 504 meets 90 minutes, once a week for 11 weeks from the first week of class until the Thanksgiving Recess, and focuses on reading and analyzing articles from the primary literature with brief presentations by students. The intent of this schedule is to support the students in developing the skills necessary to analyze the primary literature, begin to present components of scientific articles in a group setting, and complete these goals in a time frame that does not compete with end-of-semester examinations. The first meeting is a presentation by a course director on Effective Powerpoint Presentations. The following 10 meetings allow two weeks to cover each of five topics. Each topic focuses on a high quality article selected from a portfolio created by the instructors of the Fall first-year Core Curriculum for the Biomedical Sciences (BMS) Graduate Program (BMS 501, 502, and 503). Topics vary from year to year. The first week of each topic examines the components of the chosen article (purpose and significance) and is led by one of the course directors. The second week includes short presentations by students on experimental design and data analysis from the articles and is facilitated by a content expert from one of the Core BMS Courses.

Concurrent: BMS 501, BMS 502, BMS 503**BMS 505: Art of Scientific Communication II**

1 Credits

Advanced topics in scientific analysis, writing, and oral presentation using primary literature sources. BMS 505 Art of Scientific Communication II (1) The overall goal of BMS505 is to further the

development of students as scientific communicators that began in BMS 504. This includes enhancement of the knowledge base and communication skills, in written and oral presentations, required for effective scientific exchange and engagement. BMS 505 meets 90 minutes, once a week for 10 weeks from the first week of class until the end of April, and focuses on reading and analyzing articles from primary literature with extended oral and written presentations by students. Topics vary from year to year and focus on research or curricular interests of students enrolled in the course.

Prerequisite: BMS 504

BMS 506A: Biological Basis of Human Health and Disease A

2 Credits

Cellular, molecular, genetic, and biochemical basis of organ function pathology.

Prerequisite: BMS 501 and BMS 502 and BMS 503

BMS 506B: Biological Basis of Human Health and Disease B

2 Credits

Cellular, molecular, genetic, and biochemical basis of organ function pathology.

Prerequisite: BMS 501 and BMS 502 and BMS 503

BMS 512: Data Analysis For The Biomedical Laboratory Scientist, A Practical Approach

2 Credits

Biology is becoming increasingly computational as new technologies are producing massive amounts of data. The quantitative data need to be organized, graphed, and interpreted. This course will teach students the theoretical and practical aspects of experimental design, hypothesis testing, statistical analysis, and linear and non-linear curve fitting. This course will pair lectures describing theory with applications involving problem solving. Students will learn to program so they can analyze complex data sets. The students will increase their understanding of statistics and have the wherewithal to analyze big data sets. The course will end with a final project involving image analysis in which the students will create scripts and functions to analyze the colocalization of fluorescent proteins in cells.

BMS 520: Human Integrative Physiology

3 Credits

This course explores whole organ physiology emphasizing skeletal muscle and exercise physiology, cardiovascular, renal and urinary, respiratory, gastrointestinal, and endocrine. BMS 520 Human Integrative Physiology (3) Human Integrative Physiology considers the function of the mammalian organism with an emphasis on system physiology. This course builds upon the strong foundation of cellular processes, molecular interactions, and genetic regulation provided in BMS 501, 502, 503 and allows students to develop an appreciation of the integration of biological function. The course is organized into multiple sections that focus on different organ systems. Initially, the course reviews principles of excitable cells and discuss sensory transduction, the autonomic nervous system, and motor system physiology. Next, students learn the structure and function of skeletal muscle physiology including muscle contraction, force generation, and movement. The course then focuses on the

structure and regulation of the cardiovascular, renal, and respiratory systems. Subsequent sections cover gastrointestinal and endocrine systems by building upon the cellular and molecular processes covered in BMS 501, 502, and 503. Each section teaches the basic design of the system, explores the physiological principles of function, and examines how each system contributes to homeostasis and pathophysiological disease. Class material is covered through lectures and primary literature.

Prerequisite: BMS 501 , BMS 502 , BMS 503

BMS 550: Fundamentals of Cancer Biology

1 Credits

Tumorigenesis is a multistep process driven by genetic and molecular changes that occur over time. Although cancer is a heterogeneous disease, many human tumors exhibit similar acquired physiological features. This course employs an integrated approach to teach the fundamentals of cancer biology with focus on the role of growth factors, oncogenes, tumor suppressor genes, and signal transduction mechanisms in tumor formation. Building on this foundational knowledge, subsequent sessions address the multistep nature of tumorigenesis as well as the role played by the tumor microenvironment as tumors progress and spread. Current topics on bioinformatics and therapeutic management are covered in the last week of the course.

Prerequisites: BMS 502, BMS 503

BMS 551: Cancer Genetics

1 Credits

Genomic instability is a major hallmark of carcinogenesis. This course will examine how various forms of genome instability promote cellular transformation. The impact of both inherited and somatic mutations will be evaluated. Mechanisms of genomic instability will be explored, to understand how their dysregulation results in cancer. Epigenetic mechanisms of carcinogenesis will also be covered. Finally, novel therapeutic approaches that exploit tumor-specific mutations will be presented. As the part of this course, students will evaluate seminal research papers and the most recent findings in the literature, and learn the relevant experimental approaches employed in the field.

Prerequisites: BMS 502, BMS 503, BMS 550 Recommended Preparations: BMS 550

BMS 552: Tumor Metabolism

1 Credits

Cancer is a disease of dysregulation of cellular growth machinery leading to loss of growth suppressive mechanisms, increased growth promoting signaling, and other key hallmarks supporting the clonal expansion of malignant cells. As the cancer phenotype progresses the tumor requires increasing amounts of metabolic intermediates to continue to grow. This leads to dramatic changes in the use of glucose, fatty acids, nitrogen containing metabolites and sterols by the tumor. These cellular changes have cascading effects on the cells in the local tumor microenvironment as well as other more distant environments such as the bone and skeletal muscle which can lead to organism wide metabolic dysregulation. The objective of this course is to provide an overview of these processes at the cellular, organ, and organism levels with emphasis on the interactions of the metabolic pathways and the potential to intervene in this metabolic dysregulation for the treatment of cancers.

Prerequisite: BMS 550

BMS 553: Cancer Biology Colloquium

1 Credits/Maximum of 2

Students will be exposed to a range of topics in cancer biology from the primary literature to expand their knowledge of current state-of-the-art research in cancer biology, and to enhance their critical thinking skills and ability to critique the primary literature.

BMS 554: Cancer Therapy and Immunology

2 Credits

This course gives students an overview of the fundamental processes leading to cancer development but with a focus on using drugs, immunological approaches, or interventions to combat these processes. Specifically, the course will focus on drugs targeting the various processes that lead to cancer development. The objective is to impart an understanding of the concept of cancer and the use of drugs or immunological approaches, to combat it in the broadest sense. This will be accomplished by: 1. Imparting an understanding of the basics of cancer biology and how drugs or immunology can be used to combat this disease (e.g., be able to interpret data from the cancer literature involving this material). 2. Know the major processes leading to cancer development as well as current and future drugs that will target these processes. 3. Obtain an understanding of the challenges in cancer drug development and discovery of a cure for the disease. 4. Understand the process of drug discovery and development, the challenges and opportunities inherent in it, and its relation to cancer drug development and treatment. 5. Develop a clear overview of the theory and methods that are used in the overall process of drug discovery and development for the treatment of cancer.

BMS 562: Principles of Immunology C: Dysfunction and Manipulation of the Immune System

1 Credits

Investigation of diseases associated with immune system dysfunction and the manipulation of this system to prevent and treat disease.

This course will investigate the basis for human diseases that are associated with deficiencies or dysregulation of the immune system. The content builds on foundational knowledge of the immune system to demonstrate the interplay of immune components during disease processes. Students will be able to recognize the types of immune deficiencies and mechanisms of immune dysregulation that contribute to disease. In addition, students will apply this knowledge toward an understanding of how manipulation of the immune system can be used both to prevent and treat disease.

BMS 564: Concepts in Virology

2 Credits

The objective of the Concepts in Virology course is to describe the lifecycle of representative RNA and DNA viruses and the relationship between the virus and the host at the molecular level. Emphasis is placed on developing an understanding of the experimental systems used to elucidate individual steps in virus lifecycles and interactions with the host cells. Host cell-virus interactions leading to the production of progeny virus and interactions involved in establishing and maintaining long term interactions, such as latency and effects on cell growth, are discussed in detail. While some didactic lectures are provided, reading and discussion

of the primary scientific literature is an integral component of the course. Students will gain a comprehensive view of the interaction between a virus and its host at the molecular level. In addition, students will gain an understanding of the experimental systems used to elucidate steps in the virus lifecycle.

Prerequisite: MICRO 550

BMS 566: Viral Oncogenesis

1 Credits

This course will provide an understanding of the role of viruses in the development of cancer in humans and the molecular mechanisms involved. The course will build on an understanding of normal growth control of cellular proliferation to determine the molecular mechanism through which oncogenic viruses exert their effects on cellular proliferation and survival. Students will gain an understanding of the contribution of an underlying human immunodeficiency virus infection and will be able to apply this knowledge to an understanding of the cooperative effect of HIV and other viruses.

BMS 567: Viral Pathogenesis

1 Credits/Maximum of 999

This course addresses methodologies used to study viral pathogenesis and recent advances in the field. The Viral Pathogenesis course will cover multiple aspects of the study and implications of viral/host interactions at the extracellular or organismal level. The course will give introductions to each topic, and will then examine recent primary literature. The aim of the course is to provide students with foundational knowledge to be able to frame experimental questions, knowledge of recent experimental techniques, and the ability to analyze experimental data and develop firm conclusions from these data. The course will examine both the host response to the virus and the ability of the virus to evade mechanisms deployed by the host to enhance viral replication and subsequent transmission.

BMS 568: Current Topics in Translational Cancer Research

2 Credits

Current Topics in Translational Cancer Research is designed to prepare students to be the next generation of translational cancer researchers. The students are expected to have a basic knowledge of cancer biology and research techniques. The content will include cancer research that is currently being conducted as well as recently completed and will introduce both new technologies as well as new theories on cancer research. The course will offer students an opportunity to acquire skills in developing and implementing hypothesis-based research studies that can lead to clinical therapeutics. The students will learn how to identify potential targets for therapy of cancer at all stages of development, from tumor initiation through progression and metastasis. The development of drugs from design and testing to investigational new drug status and FDA approval for clinical use will be discussed.

Prerequisite: BMS 550

BMS 571: Graduate Clinical Rotation

3 Credits

This course allows graduate students at Hershey and University Park to gain experience in the clinical arena. BMS 571 Graduate Clinical Rotation is designed to allow graduate students at Hershey and at

University Park to gain intensive experience in the clinical arena in the area of their dissertation research. The site of the clinical rotation and specific responsibilities of the student are determined by the clinical mentor that is matched with the student. Clinical mentors will indicate their willingness to sponsor a student and will outline the associated opportunities and responsibilities of the specific clinical rotation. The specific rotation will be selected by the student and the dissertation mentor to complement the student's graduate studies. Opportunities during the clinical rotation: The rotation typically will last 6 - 8 weeks and the student will be in the clinic and/or engaged in clinical activities for about 4h/week. During this rotation, students will have a range of opportunities including: attending Grand Rounds, attending Resident and Department Seminars and lectures, shadowing physicians, attending clinical research meetings, attending relevant case conferences, and, if appropriate, observing surgery. Students also may engage in a practical hands-on analysis of the subject matter (e.g., via an analysis of data, histology, MRI, etc.) and they will be involved in the discussion of relevant cases and of potential treatment strategies. Requirements: Course-specific policies and expectations for all students (i.e., for all students from Hershey and from the University Park Campus).(1)all students must complete an Infectious Disease Summary; an Insurance Waiver and a Confidentiality form. The forms will be located at the CANVAS course site. All 3 forms must be received by Graduate Education Office before the start of the Graduate Clinical Rotation. (2) Orientation Meeting: All students are required to attend a 2 hour mandatory Orientation Meeting where issues will be discussed related to the course requirements, what to expect in the clinical setting, HIPAA regulations, what is and is not appropriate, how and when to interact with patients, how physicians collect data from patients, terminology, hierarchy, and differences in thinking styles between clinicians and scientists. Students will not be allowed to begin their rotation if they fail to attend this mandatory meeting.

Prerequisite: The student must: (a) be at least a 2nd year graduate student, (b) select a thesis relevant clinical rotation, and (c) have been approved by the course director

BMS 581: Molecular and Translational Approaches to Human Disease
3 Credits

This course teaches students the scientific process used to understand the molecular bases of diseases and the development of novel therapies. BMS 581 Molecular and Translational Approaches to Human Disease (3) The course utilizes clinically relevant diseases as specific examples of applying an integrated approach to elucidate a mechanistic understanding of disease pathophysiology and the development of novel therapies. Over the 15-week period of the course the students study five specific diseases or complications of diseases, each over a 3-week period. The diseases used represent areas of high impact on Western society or ones in which specific principles of mechanistic understanding or therapeutic development are clearly illustrated. The diseases also represent strengths of the research at the Penn State Hershey such as cancer, diabetes, cardiovascular disease, and infection and inflammation. The instructors use primary literature to demonstrate the scientific approach used to test specific hypotheses related to disease mechanism. At the end of the 3-week period, the students use team-based learning to develop experimental approaches to study novel aspects of the disease pathology or therapeutic development.

Prerequisite: BMS 501 , BMS 502 , BMS 503

BMS 590: Colloquium

1 Credits/Maximum of 6

Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

BMS 591: Biomedical Research Ethics

1 Credits

Education in research ethics for biomedical scientists. Meets U.S. Public Health standards for education in responsible conduct of research.

BMS 595: Internship

1-12 Credits/Maximum of 12

Supervised off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

BMS 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

BMS 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

BMS 597B: **SPECIAL TOPICS**

3 Credits

BMS 597I: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

BMS 600: Thesis Research

1-15 Credits/Maximum of 999

Laboratory work on thesis project.

BMS 601: Thesis Preparation

0 Credits/Maximum of 999

BMS 601 is available to full-time Ph.D.-degree candidates who have passed the comprehensive examination and met the two-semester residence requirement.

BMS 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

Off-campus laboratory work on thesis project.

BMS 801: Writing Grant Proposals for Biomedical Research

1 Credits

This course will give students experience with the preparation of and submission process for grant proposals. BMS 801 Writing Grant Proposals for Biomedical Research (1) This course provides students with a hands-on learning approach to the process of submitting competitive grant proposals. It will inform students of the types of grants that exist, including training fellowships for which they may be eligible. Students will learn of the many different types of organizations, both public and private, that offer biomedical research funding. A majority of the course will focus on the proposal sections pertaining to the research plan emphasizing the purpose of each section along with strategies to create an effective, successful proposal. The proposal sections to be covered in detail are: specific aims, significance, innovation and approach. In-class discussions and team-based learning activities will be used to highlight the teaching objectives for each session. Using these in-class experiences as a guide, students will apply the key aspects of proposal writing by completing a proposal as part of a grant-writing team. The proposal review process will be discussed and a demonstration of the review process will allow students to understand who reviews proposals and how proposals are reviewed as well as to allow them to participate in the review process. In addition to these writing and review experiences, strategies for the oral presentation and defense of a proposal will be covered. By the end of the course, a student will be able to write an effective grant proposal and have the knowledge of how to present and defend that proposal orally, all skills required for a successful career in the biomedical sciences.

BMS 802: Translational Research in Medicine (TRIM)

1 Credits/Maximum of 5

Translational Research in Medicine (BMS 802) is a mentorship course that provides post-comprehensive MD/PhD graduate students with the opportunity to work one-on-one with a clinician scientist mentor that will allow students to build upon and hone their clinical skills (history taking, physical exams). The course will also allow students to explore different sub-specialties and develop their clinical network. The students will also become proficient in writing SOAP notes and in learning how to integrate their basic science knowledge with their clinical exposures. These opportunities will make it possible for students to integrate their clinical experiences with their PhD thesis projects. By the end of this course students will be expected to be able to: 1. Perform a detailed history using agenda-setting, open-ended questions, and Chronology, Onset, Description, Intensity, Exacerbating factors, Remitting factors, Symptoms (CODIERS) which are an important piece of the medical school's Patient Centered Interviewing Technique. 2. Perform a thorough physical exam 3. Apply basic science knowledge to clinical problem solving 4. Write a comprehensive SOAP note (A framework for writing progress reports about a patient) 5. Write a case report based on a patient seen in clinic (optional but highly suggested) This course is specifically designed for post-comprehensive MD/PhD students, to build upon and hone their clinical skills during the non-clinical years of training and to begin to develop a translational research project that will be further explored in the M3 medical course Advanced Translational Medicine.

Biorenewable Systems (BRS)**BRS 500: Research Methods**

3 Credits

Foundation in research philosophies, methodologies, issues and policies; measures of research quality; critical thinking and discourse; research report writing; professional development; research ethics. A B E (BRS) 500 Research Methods (3) A B E/BRS 500 is a course designed to assist students entering and advancing in their research career to: better investigate and practice the art of scientific investigation; openly explore and discuss what it means to be a part of the scientific and research enterprise at a major academic setting; gain skills and experiences in critical evaluation and discourse; learn the process of developing and preparing a research proposal from initial concept to near-final written product; better understand the expectations for responsible and ethical conduct as a scientist/student/individual; and further develop their philosophies and capabilities as future scientists and professionals. During this course students will continually read, think, discuss, write, critique, re-read, re-think, re-write, and communicate with other students, faculty, and professionals. The course will provide a setting to allow them to further develop their personal, professional, academic, and scientific goals and capabilities.

Cross-listed with: ABE 500

BRS 501: Biobased Polymers

3 Credits

The chemistry, structure-property relationships, and industrial applications of biobased polymers from plant and agricultural feedstocks.

BRS 502: Human Behavior and ethics in Management and Technology

3 Credits

Ethical leadership continues to be a key issue in our society and is a topic of growing interest to the public and researchers alike. Our world more than ever needs ethical leadership to address critical sociotechnological problems such as climate change, sustainable energy and materials, quality food and water, population growth, prejudice, and global conflict to name just a few. This course will provide students with an improved mechanistic understanding of basic human behavior foundational to ethical leadership and decision making. Specifically, a series of important psychological studies will be examined which provide insights into human needs, personality, individual and social behavior, and leader-follower dynamics which are needed to identify new approaches for developing and managing leadership. Students will explore the literature themselves and share their findings and insights with the larger group. Students will apply what they learn by proposing new management processes for ensuring ethical leadership and decision making and share those with their peers.

BRS 504: Biorenewable Systems Analysis

3 Credits

This course will introduce students to the major foundational concepts in the field of Sustainability and cover in-depth technoeconomic (TEA) and life cycle analysis (LCA), the two predominant tools utilized to quantitatively evaluate economic, social, and environmental sustainability of products, processes or services. While the course emphasizes

quantitative methods, readings and discussions will also include social and ethical aspects of sustainability, which are critically important and will help to frame analyses with these considerations in mind. Social considerations will include issues of race, equity and justice. TEA is a methodology for the assessment and comparison of the technical and economic feasibility of emerging technologies. LCA is a systematic and holistic approach that enables designers and planners to identify the most impactful stages of a supply chain so that we might strategically intervene to improve the system. Emphasis on the unique challenges of bio-based systems will be highlighted throughout. Students will also develop estimation, data verification skills, how to consider uncertainty in analysis, and learn how materials and energy flows lead to impacts to ecological and human systems. This course will facilitate development of critical thinking skills to holistically consider systems to develop the human, materials and energy transactions that can lead to more renewable and sustainable systems.

BRS 511: Structural BioComposites

3 Credits

Manufacture and practices related to the production of engineered biocomposites processed from lignocellulosic materials.

BRS 550: Applied Bioproducts Marketing

3 Credits

Bioproduct marketing applications for solid and engineered wood products and biorefinery value chain output including environmental services, energy, fuels, and co-products.

BRS 551: Sustainable Business Strategies

2 Credits

Coverage of business strategies that relate to sustainability and environmental issues.

BRS 568: Applied Biomanufacturing Laboratory

3 Credits

In partnership with the Center of Excellence in Industrial Biotechnology, this hands-on course takes place in the state-of-the-art CSL Behring Fermentation Facility. Students gain experience in the principles and methods used to produce bio-based products. Lab activities span upstream to downstream processing with exposure to fermentation processes in bioreactors, cell lysis, filtration, and chromatography.

BRS 590: Colloquium

1-6 Credits/Maximum of 12

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

BRS 595: Internship

1-9 Credits/Maximum of 12

Supervised, research-oriented, off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

BRS 596: Individual Studies

1-9 Credits

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

BRS 597: Special Topics

1-9 Credits/Maximum of 15

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

BRS 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

BRS 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

BRS 602: Supervised Experiences in College Teaching

1-3 Credits/Maximum of 6

Provides an opportunity for supervised and graded teaching experience in undergraduate biorenewable systems courses.

BRS 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

Biostatistics and Epidemiology (BIOST)

BIOST 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

BIOST 595: Internship

1-18 Credits/Maximum of 18

Supervised, research-oriented, off-campus, nongroup instruction, including field experiences, practicums, or internships.

BIOST 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

BIOST 601: Ph.D. Dissertation

0 Credits/Maximum of 999

Ph.D. Dissertation

BIOST 890: Colloquium

1-3 Credits/Maximum of 4

Continuing, professionally oriented seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

Business - CA (BUS)

BUS 500: Negotiation, Communication, Teamwork

2 Credits

Experience-based learning approach to developing effective teams and work organizations; emphasis on developing reflective thinking and interpersonal skill sets. BUS 500BUS 500 Negotiation, Communication, Teamwork (2) This course provides students with an enhanced understanding of their own behavior, the behavior of others, and the capability to deal more effectively with people and groups in organizations. Primary emphasis is placed upon application of experiential learning theory in developing the ability to perform well as a member of a team, and also in facilitating team effectiveness. As adult learners, students are empowered to become active creators of their own learning, and working with the

Prerequisite: admission to the MBA or MSIS program

BUS 502: Business Research Applications

3 Credits

Critical evaluative techniques of business research.

BUS 505: Data Analysis for Business Decisions

3 Credits/Maximum of 999

Selection and application of statistical methods and use of business databases to support managerial decision-making, interpretation and presentation.

BUS 510: Business Analytics and Decision Modeling

3 Credits

Methods for solving problems that include both time evolution and uncertainty. Focus on regression analysis, simulation and advanced data analytics. This course discusses concepts and tools to make informed managerial decisions through interpretation and analysis of data. The aim is to (1) familiarize students with the concepts of data interpretation; (2) provide students with language, insights, and tools used to analyze data and model operations; (3) provide students with the opportunity to use these tools, to understand their various applications, and to interpret analyses done by others. The course will focus on regression analysis, non-linear regression analysis, mathematical and simulation modeling, and advanced data analysis techniques. When students successfully complete this course, they will be able to demonstrate use of analytical tools for modeling and optimizing business decisions and also analyze the results.

Prerequisite: BUS 505

BUS 515: Business Ethics and Corporate Governance

3 Credits/Maximum of 999

Legal aspects of managing for-profit corporations including (i) corporate governance, (ii) ethical decision-making, and (iii) public policy and legislation regarding business decisions. BUS 515-Business Ethics, Governance, and Law; covers a wide range of important topics regarding how firms are governed. The first part of the course grounds students in the inner workings of corporate boards of directors (BODs). Topics in this section include: - The need for governance and BODs; - The types of people that sit on publicly traded BODs; - The role of committees within BODs; - The voting process in corporations; - The types of decisions that BODs are involved in; and - The role of shareholders and activist investors. The course then delves into the setting and execution of ethics policy within firms, often either initiated or approved by the BOD. Students read a number of "Codes of Conduct" from firms that they are familiar with (i.e. Dell, Apple, etc) and then perform research that allows them to see if the firms match their actions with their words. Analysis is done through measuring the negative externalities that flow from certain decisions. Specific topics in the ethics section include: - The larger purpose of corporations in society; - Corporate political activity; - Decision-making and anti-trust violations; and - Bankruptcy filing and a BOD's ethical and fiduciary duty to shareholders. Finally, the course considers general business law that managers must be cognizant of during the decision-making process. Topics include: - Federalism in the U.S.: The difference between state and federal law; - Incorporation and Bylaws; - Criminal vs. Civil Law; and - Consumers and the Law.

BUS 580: Business and Sustainability

3 Credits

An inter-disciplinary and global perspective on the business case for social responsibility, environmental stewardship, and transparency in corporate governance. This course provides an overview of principles and practices from the natural and social sciences, arts, humanities, and professional disciplines that contribute to understanding and responding to increasing concerns over the consequences of world population growth (now in excess of eight billion people), climate change, energy, natural resource use, environmental degradation, and calls for a more fair distribution of limited and diminishing resources. Issues of corporate sustainability and social responsibility are examined particularly as they pertain to the development and application of business strategy and practices that build social equity, and restore environmental quality while maintaining long-term profitability and enhanced competitive advantage. While the concept of sustainability has existed for some time, it is relatively recently that managers have started to explore its applications to organizations and managerial behavior beyond the basic ideas of corporate social responsibility and recycling. This course moves beyond these basic ideas to place sustainability in its historical and conceptual context by examining the history and definitions of sustainability in organizational management, the role of current drivers and stakeholders, and the advantages and disadvantages of various frameworks and methods for integrating and managing sustainability within organizations, and in their environments. Selected examples of contemporary research and organizational cases will be analyzed to gain a sense of effective and ineffective approaches to sustainability, as well as addressing issues of standards, measurement, and transparent reporting.

Prerequisite: BUSEC 502 and MNGMT 511

BUS 588: Strategic Management

3 Credits

Analyzing external and internal environments of firms to develop sustainable competitive advantages. Strategic Management is the MBA capstone course designed for students to integrate analytical skills learned in functional courses with core principles of strategy formulation, implementation, and performance review. Students will analyze internal and external factors and make recommendations for how firms can create sustainable competitive advantage in the global market environment.

BUS 589: Strategic Venture Planning and Innovation

2 Credits

Development and presentation of a venture plan including product development; market research; competitive analysis; financing and capitalization; organizational structure. BUS 589 BUS 589 Strategic Venture Planning and Innovation (2) The purpose of BUS 589 is to have the business student apply strategic management theories and practices acquired in BUS 588 to a specific, practical project in order to further the understanding of the process of creating and managing a strategy based on innovation (an entrepreneur strategy). This course is a direct extension of BUS 588 and should be taken immediately following it. The process of innovation is analyzed in detail together with the influences on it. The effects of various contexts on entrepreneurial strategy will be considered. Finally, issues related to the implementation and management of a strategy based on innovation will be discussed. Students are required to develop a comprehensive new venture plan for an actual business organization to demonstrate knowledge of organizational design from a strategic perspective. Students will have to apply management, marketing, finance, information systems, and accounting knowledge in the new venture proposal. They must also demonstrate their knowledge of the influence of external (environmental) contexts on strategy formulation and implementation through the use of appropriate analytic frameworks. Finally, they must demonstrate a grasp of what constitutes competitive advantage within the strategic context that they have chosen for their project.

Prerequisite: BUS 588

BUS 595: Internship

1-18 Credits/Maximum of 18

Supervised off-campus, nongroup instruction including field experiences, practicums, or internships. Written and oral critique of activity required.

Prerequisite: prior approval of proposed assignment by instructor

BUS 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

BUS 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

BUS 890: Colloquium

1-3 Credits/Maximum of 9

Continuing, professionally oriented seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

BUS 897: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject with a professional orientation that may be offered infrequently.

Business Administration (BA)

BA 511: Seminar on Statistical Analysis

3 Credits

This course provides a breadth of statistical skills necessary for advanced data analysis. Students will learn how to employ data analytic processes that address challenges associated with experiments, surveys, time-series, panels, and/or multilevel models. Software packages, concepts, and business applications will vary and evolve to keep pace with technology, theory, and instructor interest.

BA 512: Quantitative Analysis for Managerial Decision Making

2-3 Credits

This course is an introduction to the mathematical methods and tools of managerial decision making under uncertainty. While the main topics of the course are probability, statistics, decision analysis, simulation, and regression which are mathematical by nature, emphasis is placed on improving an intuitive understanding of the underlying issues in these topics. Rather than simply memorizing mathematical formulas, the student is encouraged to gain a better understanding of why certain concepts are used, and to learn what type of information is relevant to evaluate different situations of uncertainty. Students are expected to apply and discuss how the quantitative analysis they develop aides in business decision making. Students are expected to gain familiarity with various state of the art software packages for this analysis.

BA 513: Advanced Microeconomic Analysis for Business

3 Credits

This course discusses topics in advanced microeconomic analysis with an emphasis on applications to applied research areas in business and other related disciplines. Topics include (but are not limited to) general equilibrium, choice under uncertainty, game theory, mechanism design, and behavioral economics. An area of particular focus is how incomplete and asymmetric information impacts competitive and strategic behavior by individuals and firms in a variety of applied settings. The materials emphasize theoretical models prevalent in microeconomic research, and students are expected to develop a familiarity with the use of mathematical modeling in economics. Whenever possible applications

to related applied disciplines such as those in finance, supply chain management, accounting, and agricultural economics will be highlighted and discussed. Experimental methods will be used at times to motivate and discuss various economic principles.

BA 523: IT Strategy

2 Credits

An introduction to information technologies critical to business organizations.

BA 528: Business Simulation

1-3 Credits

A team-based course during which students will manage a simulated firm. B A 528 Business Simulation (1-3)Using the business simulation, teams of 4-5 students will compete against other teams in a particular industry. The team members will have to make all the decisions about how to run the firm, including overall strategy, product design, detailed marketing plans, factory operations, and financing.

BA 533: Economics for Managers

2-3 Credits

This course provides students with an overview of the foundations of microeconomic analysis. The primary objective is to develop their ability to apply fundamental microeconomic concepts from price theory and game theory to a wide range of managerial decisions, as well as public policy issues.

BA 545: Business, Government and International Economics

2 Credits

Understand how macroeconomic events and policies affect the global economy and business decisions. B A 545 Business, Government and International Economics (2)Changes in interest rates, swings in the business cycle, new international trade agreements: All are macroeconomic events, and all can dramatically impact business. Accordingly the class is a synthesis of institutional, theoretical and historical perspectives.

BA 559: Qualitative Analysis in Business

3 Credits

This course provides the foundational skills necessary for conducting qualitative research in an applied business context. Students will explore some of the following topics: ethnography, observation, interviewing, grounded theory, discourse analysis, case method, narrative analysis, and action research. Through this process, students will be introduced to the epistemological foundations of qualitative research, learn different methods of data collection, introduce different techniques for coding and analyzing qualitative data, and provide guidance on creating rigorous qualitative research.

BA 560: Applied Business Research

3 Credits

This course grounds students in the process of developing translational research broadly within the business domain. Students will learn how to identify applied challenges, develop research questions to address these

challenges, design applied studies, and frame their work using rhetoric that connects with the applied community.

BA 571: Strategic Management

1-3 Credits

Analysis and application of concepts and techniques aimed at successfully developing and implementing competitive strategy in a complex business environment. B A 571 B A 571 Strategic Management for Converging Economies (3)This course introduces students to the field of strategic management and the skills and tools used by general managers to make strategic decisions. Students learn to use frameworks and perspectives for analyzing industries, competitors, and companies with an overall objective of positioning the firm to attain and sustain competitive advantage. Students learn how to identify the industry and firm-level determinants of profitability and then relate those factors to the development of competitive strategy within the context of responsible business practice. Students also learn how to evaluate strategies to understand how and why companies are successful or not. Finally, students will learn how senior managers use integrative approaches for solving strategic problems.

BA 575: Capstone Business Case

4 Credits

A team-based project course that requires students to analyze an actual business problem from a firm or nonprofit organization. B A 575 Capstone Business Case (4)The Capstone Business Case course is designed to allow second-year MBA students the chance to integrate the knowledge they have gained to date in the program. True business problems are not narrow, functional area problems; rather they require teams of people to come together to jointly solve a problem that extends across many areas. For example, to assess the commercial viability for a new product requires contributions from economics, marketing, supply chain, finance, strategy, and corporate innovation. The more opportunities students have to work on real cross-functional problems, the better prepared they will be to solve them once they are actually on the job. In addition, working on a team and having to present the results gives students the ability to practice communication, teamwork, and leadership skills that are vital to success on the job.

BA 580: Doctorate of Business Administration Culminating Research Project

6 Credits/Maximum of 18

This course provides Doctorate of Business Administration students with the opportunity to identify a practice problem or clinical question and investigate the literature related to this selected area of interest. Students will develop and implement a comprehensive project to address the problem. Students will also disseminate the results in both a scholarly presentation and manuscript for publication.

Prerequisites: BA 560

BA 591: Applied Communications

1 Credits

Develop oral and written communication strategies to succeed in professional and academic contexts. B A 591 B A 591 Professional Development for Business Academics (1)This course is designed to equip doctoral students in business with skills and knowledge that will assist

them in successfully completing their doctoral studies and moving on to a successful career as a business academic. These skills fall into three broad categories: 1) communication skills, 2) research skills, and 3) interpersonal skills (which include ethical behavior). The course is designed to cover many crucial skills and career issues that may be overlooked during a doctoral student's normal course of study.

Prerequisite: admission to the doctoral program in Business Administration

BA 595: Internship

1-12 Credits/Maximum of 12

Supervised off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

BA 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

BA 596A: ****SPECIAL TOPICS****

1-6 Credits

BA 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

BA 599: Foreign Study--Business Administration

1-12 Credits/Maximum of 12

Full-time graduate-level foreign study at an overseas institution with whom linkages have been established.

Prerequisite: acceptance in established exchange program International Cultures (IL)

BA 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

BA 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

BA 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

BA 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

BA 800: Marketing Management

2-3 Credits

This course provides an examination of the competitive landscape faced by marketing managers and the techniques used to provide data-driven insights to improve firm decision making. Students will learn how to assess the marketing environment which include the 5 Cs (Customer, Company, Collaborator, Competition, and Context) and how the 5 Cs impact marketing decision making. Students will learn how to utilize the marketing environment to establish a data-driven marketing strategy, i.e., segmentation, targeting, and positioning. As an example, this can include understanding how to conduct cluster analysis for segmentation, discriminant analysis for targeting, and perceptual and preference mapping for positioning. Students will learn how to make data-driven tactical marketing decisions, i.e., product, price, place, and promotion. As an example, this can include understanding how to conduct conjoint analysis for new product developing, base price analysis (BPA) for pricing, and marketing mix models for promotion decisions. Finally, students will learn how to link their data-driven marketing decision to important business outcomes, e.g., market share, return on marketing investment (ROMI), and profitability. Marketers will find the course provides them skills to immediately utilize data in their marketing decisions. Non-marketers will build skills related to understanding how data can be utilized for general business decision making. This course provides basic foundations of theories and tools used in subsequent elective courses in marketing.

BA 801: Management

2 Credits

This course is concerned with understanding and managing the behavior of people in organizations. The course will provide exposure to many of the concepts and skills that will help students become a more effective manager and organizational leader. This course includes tools that help students diagnose, understand, and develop solutions to management problems. The course will draw upon both the academic and practitioner literature to understand many facets of organizations and of the thoughts, feelings, and actions of people who work in them. It will focus on: 1) developing students' conceptual understanding of issues involved in managing people; 2) providing opportunities for direct or vicarious learning of managerial skills that have been identified by practicing managers as being most important to their performance; 3) giving students insight into their own attitudes, beliefs, and management philosophy; 4) creating a forum for discussing management issues with colleagues.

BA 802: Team Process and Performance

1-3 Credits

This course provides students with basic knowledge about predictable team dynamics and how to constructively deal with issues that arise in the first year M.B.A. teams. The course focuses on observation, diagnosis, and intervention skills for developing effective teams. Topics include diagnosing group dynamics, giving and receiving feedback to teammates, cross-cultural communication, and conflict management techniques. The course provides a real-time practicum for diagnosing team issues and addressing team problems and conflicts. Students apply team process concepts and techniques as they work to complete team projects in their other core M.B.A. classes. Students leave the course

with an understanding of how to successfully lead a team and how to diagnose and correct dysfunctional team behaviors.

BA 803: BUSINESS ETHICS

1 Credits/Maximum of 999

A study of ethical conduct in organizations and how cultural differences and personal conduct impact business decisions. This course focuses on developing the ability to understand ethical conduct in business organizations. Understanding how to think about and manage personal ethical conduct is a key learning objective along with a review of how an organization fosters a culture that supports ethical behavior. Students will also learn how cultural differences impact business decisions in a global environment.

BA 804: Ethical Leadership

2-3 Credits

The objective of the ethical leadership course is to raise awareness of the key role played as a manager and leader in creating and maintaining responsible business conduct in work groups and organizations. The course is also intended to enhance the student's ability to deal with the complexities of ethical decision making in today's dynamic business environment by clarifying and applying personal values.

BA 805: Negotiation Theory and Skills

1-3 Credits

The ability to effectively negotiate is an essential skill for managers. Negotiations not only occur with customers or clients, but also between bosses and subordinates, among teammates and across departments. Being able to craft a successful deal, especially in difficult circumstances, requires knowledge of yourself, as well as the substantive material that you are negotiating. Effective negotiators know their own limitations as well as their strengths. They also listen well and have good analytical skills. And, they can craft agreements that garner gains for themselves as well as for other if such gains are possible. Successful negotiating is also closely allied with successful teamwork since both processes require listening, persuasion, influence skills, and creativity. This course will give students an overview of the difference between traditional (distributive) bargaining and interest-based (or integrative) negotiations. Students will learn the rudiments of interest-based negotiating and practice it in several negotiation simulations. They will learn how to identify their own and others' interests, to create and claim value and to craft constructive agreements for all parties. The course will concentrate on two person and small group negotiations as well as to deal with difficult opponents.

BA 809: Strategic Business Architecture

3 Credits

BA 809 focuses on the development and application of business architecture as a holistic discipline that produces a common understanding of the organization that is used to align strategic objectives and tactical initiatives. Business architecture bridges the gap between a company's strategy and its successful execution. A business architecture approach that delivers business value to the enterprise produces several things: - An articulation of the strategic requirements of the enterprise - Models of the future state which illustrate what the enterprise should look like across multiple business viewpoints in support of the business strategy - A road map of the change initiatives required to reach that future state - The requirements,

principles, standards, and guidelines that will steer the implementation of change initiatives The primary purpose of describing the business architecture of an enterprise is to improve the effectiveness or efficiency of the business itself. This includes innovations in the structure of an organization, the centralization or federation of business processes, the quality and timeliness of business information, and ensuring that money spent at the project level is in support of the strategic objectives of the larger enterprise. The course also develops additional capabilities for communicating, explaining, and justifying decisions relating to business architecture.

BA 810: Supply Chain and Operations Management

1-3 Credits

This course is designed to provide students with an overview of the role of operations in the organization, the kinds of decisions operations and supply chain managers make, and the impact of these decisions on the strategic and tactical position of the firm. Supply chain management is a particular focus in the course. The interaction of production, distribution and information resources plays a critical role in developing and sustaining a firm's competitive advantage.

BA 811: Financial Accounting

2-3 Credits

Business enterprises convey information to their present and potential investors and creditors through financial reports. This course focuses on these financial reports, the data they contain, how users should read and interpret financial statements, and how users can incorporate this information into their investment decision making. It also examines how managers attempt to window dress these financial statements and how the numbers might affect managerial behavior.

BA 815: Business Statistics for Contemporary Decision Making

2-3 Credits

This course provides an overview of statistical concepts and methods including descriptive statistics, probability, statistical inference, hypothesis testing, ANOVA, Correlation analysis, Contingency Tables, and Simple, Multiple, and Logistic Regression. The approach to course material will be both numerical and applied in order to provide a conceptual understanding of statistics. Applications of these methods will be applied to problems in various business settings such as Marketing, Finance, Accounting and Supply Chain.

BA 817: Communication Skills for Management

1-4 Credits/Maximum of 4

One of the most important skills M.B.A.s develop in business school is the ability to demonstrate the value of their experiences. This course provides students with targeted opportunities to develop this skill as they clearly, forcefully, and professionally represent ideas, opinions, and solutions. Students will participate in various oral, written, and graphic projects during the course. After completing this class, students will have proficiency in representing their skills, expertise, and views to business partners (clients, colleagues, employers, and shareholders). This course is spread over two semesters (2 semesters, 4 M.B.A. modules). Residential M.B.A. students must complete all 4 credits (1 credit each in mods 1,2,3,4 for a total of 4 credits). The material builds on each prior module and applies communications skills to various applications.

BA 821: Foundation in Managerial Accounting

2 Credits

Foundations in Management Accounting has two broad aims. First, it is designed to help students grasp the technical aspects of accounting for activities and processes within and between firms. Therefore, students will study methods of a) cost classification & estimation; b) cost measurement & allocation; c) profit planning; and d) evaluation and control of behavior. Second, the course emphasizes the context of managerial accounting. The firm suspends market prices that regulate behavior impersonally. Students will study how economic arrangements are organized in such non-market settings. Unlike financial accounting, the field of management accounting integrates notions from diverse fields including economics and sociology. Crucially, management accounting is situational and therefore requires and hones students' facility in both quantitative analyses and qualitative judgments.

BA 830: Emerging Technology Trends in Business

1 Credits

This course will empower future business leaders to embrace the concepts and bring the state-of-the-art technologies into their organizations to improve the bottom line of their businesses. This course focuses on emerging technologies that are characterized by novelty, relatively fast growth, prominent impact, and uncertainty. They are the tools that can disrupt industries. The appropriate application of emerging technologies can become the foundation of an organizational transformation journey that leads to improved organizational competitiveness. Conversely, the inappropriate application of any technology can lead to business setbacks and failures.

BA 831: Foundations in Finance

2-3 Credits

This course will provide students an understanding of the major financial decisions faced by modern corporations. These activities include investing, financing, mitigating risks, and returning capital to shareholders. Investing activities include acquisitions, mergers, and major capital expenditure investments. Students will estimate investment cashflows and determine how the investment affects firm value. Financing activities include valuing and issuing debt and equity securities to fund investments. Students will evaluate overall capital structure to determine optimal financing composition. Risk mitigation activities include designing hedging strategies to hedge commodity price risk. Students will select risk coverage ratios and evaluate specific forward and option contracts. Finally, students will assess how corporations return capital to its shareholders. These activities include stock repurchases and paying dividends. Students will build financial models to assess the risks and returns of the firm's activities. The models will primarily use spreadsheet software. The spreadsheets will be augmented with VBA programs, macros, and simulation add-ins. Current finance theories will be evaluated and applied to real-world decision making using current tools and technology. This course is relevant to both financial and non-financial managers. Non-financial managers will use course insights to assess the financial risks and returns of investments in areas such as marketing and supply chain. This course provides a foundation of theories and tools used in subsequent elective courses in finance.

BA 832: Global Business Environment

1-3 Credits

This course provides students with an introduction to the foundations of macroeconomic analysis. The primary objective is to develop their ability to apply fundamental macroeconomic concepts from GDP, interest rates, fiscal and monetary policy to understand how policies impact macroeconomic conditions and the environment firms face. Foundational topics in microeconomics include GDP, interest rates, inflation rates and exchange rates. We use modeling techniques to evaluate how different agents in the economy interact (consumers, firms, governments, international trade and the federal reserve) and what the impact of those interactions are on the fundamentals of the economy (GDP and interest rates). The course heavily relies on mathematical and numerical modeling in the analysis of the macroeconomy.

BA 835: Global Perspectives

1-3 Credits

This course starts with the reality that the United States is less influential in global trade, finance, economics, and business than it was in previous decades. Consequently, M.B.A. students need to be aware of the business environments of other countries, the influence of these countries in the global political economy, and new competitors emanating from other parts of the world. About two-thirds of the course is focused on understanding macroeconomic concepts, and analyzing the challenges and opportunities posed by some of the most important countries and regions and the companies headquartered there. Approximately one-third of the course examines global themes that affect virtually all companies, regardless of nationality. Companies that respond creatively to the challenges posed by technology, sustainability, demographic change, urbanization, civil society, and related issues are likely to be more successful than those that do not. The course uses an interdisciplinary approach to explore the dynamics of international business, globalization, and country/political risk. After reviewing important features of the international business landscape, we will examine the business environments of the world's major regions and select countries, particularly those where students will be going for Global Immersion, while surveying macroeconomic terms and concepts along the way. The course concludes by examining how transnational themes may affect international business in the coming years.

BA 836: Global Immersion

1-3 Credits

Global Immersion is designed around a visit to another economic region. In the past, MBA students have visited such countries as Belgium, Brazil, Chile, China, Czech Republic, France, Ireland, Turkey, and Singapore. In each country, students visit both local and multinational businesses to understand how a business gets established and run in another country; students also meet with industry and government officials to get their perspectives on the economic policies of the country. Each Immersion is coordinated by a faculty leader who plans the visit so as to appeal to a wide range of student interests.

BA 840: Business Data Management

3 Credits

Business Data Management will enable students to use various database designs to acquire the information needed to make effective business decisions. Successful students will be able to design, create, and

implement a relational database and be able to write SQL statements to obtain information from a database. In addition, students will investigate the next generation approaches for storing, manipulating, and managing web data in unstructured formats. Students will gain an understanding of the advantages and disadvantages among XML, NoSQL, NewSQL, and Relational databases. After successfully completing this course, students will have the knowledge, skills, and abilities to: - structure a database, configure it, perform analysis within it, and report from it - have adequate understanding of SQL to retrieve data from a database using SQL query language - design a database system including an ER Model and a UML class diagram, and implement the design in an enterprise database application - understand NoSQL databases, XML native databases, NewSQL databases, and the advantages and disadvantages of these databases.

RECOMMENDED PREPARATIONS: three credits of data analytics

BA 841: Business Intelligence

3 Credits

Business intelligence encompasses the IT tools for exploring, analyzing, integrating, and reporting business data for fact-based, intelligent decision making. This course primarily investigates methods and tools for exploring and analyzing large amounts of business data, also called "Big Data". Learning methods emphasize active learning in the application of methods and tools to real data and the presentation of the results. Students will be exposed to a variety of methods for analyzing both structured and unstructured data and they will work with business data sets to understand the value that can be extracted from large data sets. They will also learn how to classify and associate data to discover business rules that can be used to support decision making. The course will also cover methods to analyze social media information and tools that can facilitate such analysis and discovery. Students will work with data from real social networks to gain an appreciation of how value can be obtained from such networks. Finally, they will learn about techniques for visualizing, presenting, and communicating information in a useful way, e.g. through dashboards and with other technologies on various platforms. Upon successful completion of this course, students will have:

- acquired the tools and techniques of data cleaning and preparation, data mining, and data visualization
- become competent in analyzing both structured and unstructured data
- developed an understanding of, and an appreciation for, the complexities of mining unstructured data such as text data including documents, web pages, emails, etc.
- developed an understanding of social networks as well as mobile and location-based analytics

COREQUISITE: BA 840 **RECOMMENDED PREPARATIONS:** three credits of data analytics

BA 850: Sustainability Driven Innovation

3 Credits

This course explores sustainability as a business opportunity for developing innovative products and services. It will focus on consumer needs related to sustainability, willingness to pay for these needs, and the innovative processes necessary to create sustainable solutions.

BA 865: Strategic Leadership

1-3 Credits

This course presents a senior executive perspective on the key opportunities and challenges faced by business leaders. Course content

is based on extensive research on the experiences of senior leaders from major organizations around the world. The lessons from these experiences form the backbone of a series of discussions on the changing context for setting strategy and leading organizations in an evolving business environment. Students who complete the course will demonstrate the ability to think strategically about organizational issues and challenges, develop effective strategies for organizational performance and success, and shape organizational cultures that facilitate strategy implementation and organizational change.

BA 880: Leadership Immersion

2 Credits

This course will provide practical and hands-on exposure to leadership training and exercises that can be applied in a diverse range of professional environments and business settings. Students will assess their own leadership strengths and development areas, develop an individual leadership development plan, apply that plan in a Leadership Immersion experience, and complete a reflection paper upon return. The course provides an opportunity to apply and integrate the knowledge and skills students developed throughout the program with strategic management and leadership concepts. Leadership Immersion off-site components take students to one- to two- day leadership development programs such as: the Fire Department of the City of New York (FDNY) Fire Academy; the U.S. Marine Corps Officer Candidate School in Quantico, Virginia; the U.S. Military Academy at West Point; and Gettysburg National Military Park. All of these off-site immersion experiences focus on leadership in situations that require rapid decision-making, communication, and team cohesion in a stressful or uncertain environment.

Prerequisite: BA 801, BA 802

BA 888: Executive Leadership

3 Credits

A central tenet of this course is that leadership matters. It is a primary driver of organizational success and effectiveness. The course examines a wide range of theories on leadership and various executive leadership styles and increases student awareness of current issues in executive leadership. Students will learn how to apply the different leadership theories and styles to practical settings. The course uses practical methodologies such as case analysis, discussion and debate, and self-analysis to help students explore and apply executive leadership skills in upper-level organizational settings in a manner that motivates their peers and lower-level supervisors and employees toward achieving organizational effectiveness. It will explore how different leadership styles affect others and their organizations, and reflect on their own development as leaders and how improve their own leadership skills. Learning outcomes include developing an understanding of different executive leadership theories, understanding the effectiveness of different leadership styles in different settings and organizational contexts, applying theory to practice, and developing personal executive leadership skills.

BA 897: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject with a professional orientation that may be offered infrequently.

Business Administration (BADM)

BADM 510: Cost Management for Decision Making and Control

3 Credits

The study and use of accounting information for cost management, product costing, planning and controlling operations, and managerial decision making.

Prerequisite: B ADM501

BADM 512: Managing Effective Organizations

3 Credits

Understanding the critical and changing role of management in contemporary organizations. BADM 512 Managing Effective Organizations (3) The objective of this course is to provide MBA students with an understanding of the challenges confronting managers of contemporary organizations and a knowledge of the tools and techniques available to help them confront those challenges in dynamic workplace settings. The course will be structured around the POLC framework, a system that emphasizes the four essential functions of management: Planning, Organizing, Leading, and Controlling as an ongoing process of interrelated activities.

Prerequisite: B ADM502

BADM 513: Quantitative Methods for Business

3 Credits

This course is designed to provide a systematic understanding of design, operation, and control of business processes that transform inputs into outputs. B ADM 513 Quantitative Methods for Business (3) This course is designed to provide a systematic understanding of design, operation and control of business processes that transform inputs into outputs. The course encompasses both manufacturing and services. The focus is managerial decision-making with an emphasis on quantitative methods of analysis. Topics include operations planning and strategy, systems design, inventory management, capacity and materials planning, JIT and lean operations, quality control and management, scheduling, and project management. Quantitative methods include linear programming, decision analysis, inventory models, forecasting, simulation and queuing models.

Prerequisite: B ADM501 and B ADM502

BADM 514: Strategic Planning and Business Policy

3 Credits

Formulation of objectives and the implementation of programs to promote long-range success of the organization in a changing environment. BADM 514 Strategic Planning and Business Policy (3) Drawing from concepts in competitive strategy, organizational economics, financial economics, and industrial organization, this course will describe the skills that managers must command to create economic value through firm strategy. These skills include the ability to apply analytical tools to assess industry structure and competitors' strategies, the ability to assess the optimal scope and boundaries of the firm, and the ability to design administrative structures, systems, and processes that facilitate the development and deployment of corporate resources. Even though the course incorporates various theoretical perspectives, it

ultimately is designed to focus on the essential issues and problems of competitive strategy as experienced by managers.

Prerequisite: B ADM510 , B ADM512 , B ADM513 , and B ADM554

BADM 523: International Business

3 Credits

Survey of the theory and practice of international business.

Prerequisite: B ADM501 and B ADM502

BADM 525: Innovation and Change Management

3 Credits

Analysis of innovation sources, effects on industry structure and firm resources, and how firms can manage adoption and implementation process.

Prerequisite: B ADM501 , B ADM502 , B ADM503

BADM 526: Leadership and Ethics

3 Credits

A multiperspective review of leadership theory and research with special emphasis given to the ethical dimensions of leadership. BADM 526 Leadership and Ethics (3) The objectives of this course are to: a) increase moral awareness of ethical issues in organizations, b) consider the interrelationships between organizations and their stakeholders, c) analyze the ethical impacts of managerial decision-making, d) understand how to manage the ethical performance of people and organizations, e) develop an understanding of the ethical dimensions of leadership theory and research, f) explore the relationship between the concepts of leadership effectiveness and ethical leadership. Ethical conduct is an important issue for managers in all functional areas of business organizations. Long-term success in business depends not only on mastery of the immediate technical environment and competitive domain, but also consideration of and attention to the broader social and ethical environments in which all organizations and institutions are embedded. Leaders have an important role to play in managing the financial and ethical performance of individuals and organizations. Even though leadership is one of the most researched topics in management, most reviews of the leadership literature rarely mention the ethical dimensions of leadership. Understanding what ethical leadership is and why it is important can provide a more comprehensive view of what it means to be an effective leader.

Prerequisite: B ADM502

BADM 532: Corporate Finance

3 Credits

Application of modern corporate finance theory to corporate practice.

Prerequisite: B ADM501 and B ADM503

BADM 554: Marketing Strategy

3 Credits

An application of marketing theoretical principles from popular press publications. B ADM 554 B ADM 554 Marketing Strategy (3) This course is an investigation into current popular press publications and their

application of marketing theoretical principles to actual business situations. It includes analytical processes and an emphasis on critical thinking skills useful to upper level marketing managers.

Prerequisite: B ADM502

BADM 555: New Product Development and Management

3 Credits/Maximum of 999

This course will cover the concepts of new product/service development and brand management strategies for competition intensive firms. Identifying opportunities, developing strategies, and designing processes for the creation of new products are key responsibilities for both entrepreneurs and managers in established firms. But developing new products is also fraught with risk: an overwhelming majority fail when introduced to the market. This course is about improving the odds of placing winning bets on new products. This course is especially recommended to students who expect to (i) launch their own businesses, (ii) work as brand or product managers, or (iii) have responsibilities requiring knowledge of product strategies and management of new product initiatives. Consultants who advise clients on product strategies may also benefit from taking the course. Strategies and processes for new product development will be the core of the course. Strategy provides the context for product development — without it, each product development project is a separate and disjointed effort that has a much lower chance of success. This is one major reason why so many new products fail. Strategy for new products requires aligning new product development with market opportunities (for example in emerging markets, or by exploiting new inventions and technologies); selecting business models; and choosing effective marketing and manufacturing strategies. Process includes choosing a sequence of activities that is both rational and effective for converting ideas into compelling new products. These activities include concept development, design, prototyping, demand estimation, costing and pricing, branding, packaging, product testing, and market testing. However, not all products use the same development processes, and it is important to understand when to use which processes. It is expected that students enrolling in BADM 555 will be familiar with fundamental marketing concepts and practices. These are generally addressed in an undergraduate marketing course or equivalent professional training.

BADM 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topic or special interest subject which may be offered infrequently.

BADM 828: Negotiations

3 Credits

Negotiating is an essential task of management. Successful managers bargain, negotiate, and resolve disputes with bosses, co-workers, subordinates, suppliers, customers, competitors, and other stakeholders. Effective negotiation can improve an individual's own outcomes as well as those of the other parties involved. Ineffective negotiation not only hurts the negotiator's ability to get "things done" but can also lead to poorly constructed or failed agreements in which everybody loses. The goals of this course are to improve students' negotiating skills. In this course, students will learn the theory and practice of negotiation. Course readings, discussions, and exams are designed to develop the theoretical foundation that is needed to understand the principles of effective (and

ineffective) approaches to negotiations. Students will practice what they have learned by taking part in negotiation exercises and simulations.

BADM 834: Portfolio Management

3 Credits

The course is designed to expand the student's knowledge of the broad field of financial and investment analysis. The student will examine the basic tools of asset valuation and inputs for portfolio management. Security Analysis requires a thorough understanding of financial statement analysis, quantitative techniques, and economics. The major objectives of this course are to gain a working knowledge of the fundamentals of portfolio management - including creating an investment policy statement, asset allocation, optimal portfolio selection, and analyzing equity, debt, and alternative assets. The student will also have the opportunity to apply those principles to the management of their own (virtual) \$100,000 investment portfolio. This course expects students to be familiar with the fundamental finance concepts and practices, either through successful completion of an undergraduate finance course or equivalent professional training.

BADM 841: Principles of Applied Project Management

3 Credits

This course is a problem-based course in the application of project management processes, methods, techniques, and tools needed to manage projects in a modern business environment. The course covers the fundamental project management principles associated with initiating, planning, executing, controlling, and closing projects. Project charters, schedules, resource assignment matrices, and communication, risk, and quality control plans are all tools that can enhance effective project management and which are covered in the course. This course assumes that project management in the modern organization is a complex team-based activity, where application of effective leadership and team management principles are critical and where various types of technologies (including project management software as well as software to support group collaboration) are an inherent part of the project management process. This course also acknowledges that project management involves both the use of resources from within the firm, as well as contracted from outside the organization.

BADM 871: Business Analytics

3 Credits/Maximum of 999

This course provides a broad understanding of business analytics and managerial best practices for leveraging analytics. Advances in computational technologies, coupled with the massive amounts of data available through business activities as well as the surrounding ecosystems, have created an amazing potential for managers to leverage analytics in order to gain organizational and competitive advantages. This course takes a two-fold approach to address Analytics Methodologies. The first section of the course provides a broad understanding of business analytics and the second section demonstrates the managerial best practices for leveraging analytics. The course covers concepts such as analytics problem framing, data understanding and preparation, as well as descriptive and predictive modeling. The course incorporates applications and real-world datasets from marketing and other business disciplines for a hands-on learning experience. Best practices derived from cases are also incorporated into the course structure in order to learn the strategies required to implement and manage analytics initiatives in businesses. Students are

initially introduced to business analytics through a series of examples, use cases, and applications. Next, descriptive analytics through the use of dashboard and business reporting techniques is presented as a means for business performance management. Following this, the overall predictive analytics process is explained with emphasis on framing the analytics problem from an understanding business context. Additionally, fundamental predictive modeling concepts are covered concurrently with the introduction of exemplary modeling techniques. Students then receive an opportunity to apply these techniques through the use of different problem scenarios and real world datasets. Related topics including overfitting and visualizing model performance are covered as well. Students are presented an expected value framework to assist approaching business problems with a decision-analytic perspective. The course also covers managerial aspects of integrating business analytics within the enterprise by linking business strategy to business analytics initiatives. Approaches to initiate, manage, and sustain analytics initiatives to gain a competitive advantage are discussed with cases. At the end of the course, students are expected to have the competencies required to analyze possible opportunities for leveraging analytics across the boundaries of functional business domains, as well as apply key analytic techniques and interpret results for decision-making.

BADM 895: Internship

1-6 Credits/Maximum of 6

Supervised, professionally-oriented, off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

Prerequisite: prior approval of proposed assignment by instructor

Business Administration (BUSAD)

BUSAD 523: Prices and Markets

3 Credits

A survey of analytical concepts and techniques essential to an understanding of the business environment.

BUSAD 525: Quantitative Methods in Finance

3 Credits

Study of quantitative methods used in financial and investment analysis and modeling. BUSAD 525 BUSAD 525 Quantitative Methods in Finance (3) BUSAD 525 studies statistical and econometric methods to provide a quantitative foundation in financial and investment analysis. Students will be introduced to the statistical and econometric methods necessary in quantitative financial modeling. Students will acquire practical knowledge, skills and abilities in financial modeling, including sampling, estimation, and hypothesis testing, regression analysis and its application in finance, portfolio analysis methods, and time-series analysis and forecasting. Spreadsheet programs such as the Microsoft Excel program will be used extensively throughout the course.

Prerequisite: BA 831

BUSAD 542: Global Intercultural Management

3 Credits

This course develops students' global cross-cultural competencies and cultural intelligence to enhance ability to manage global organizations and work interculturally.

Prerequisite: MGMT 501 or LEAD 501

BUSAD 545: Negotiation Strategies

3 Credits

This course covers strategies and tactics for understanding conflicts, for negotiating effectively, and for dealing successfully with power in organizations. BUSAD 545 BUSAD 545 Negotiation Strategies (3) Although situations involving international incidents, corporate acquisitions, or national collective bargaining contracts demonstrate the dramatic effects of the need for negotiation, it is something that most people do every day. Negotiation is not a process reserved for skilled diplomats, top salespeople, or leaders of labor unions. The structure and processes of negotiation at the interpersonal level are fundamentally the same as at the corporate or international level. For this reason, knowledge about and skill in negotiating is essential to anyone who works with and through other people to accomplish objectives. It is part of the normal "give and take" of any business situation, such as negotiating salaries, arranging deals with vendors, or allocating resources for a project. Unfortunately the ability to simply recognize conflict and the need for bargaining does not insure successful negotiating situations. Negotiation is a complex human activity, involving a dynamic interpersonal process. The skilled negotiator possesses a number of skills including: the intellectual ability to understand the key facts that shape and characterize different negotiation situations; the skills to diagnose problems and select appropriate strategies and approaches to address them; and the understanding of one's own personality and value system, which affect the perception of a situation and the choice of tactics and strategy. Negotiation is a learnable process. In this course students will learn how to recognize and resolve conflict through bargaining, what the bargaining process involves, and how to plan and carry out a successful negotiation.

Prerequisite: MGMT 501

BUSAD 551: Business, Ethics, and Society

2-3 Credits/Maximum of 3

The course focuses upon the exploration and analysis of the ethical, political, technological, social, legal and regulatory environments of business. BUSAD 551 Business, Ethics, and Society (2-3) Students will explore and analyze the challenging issues that lie at the intersection of business, government, and society through a lens of business ethics. Topics covered include the importance of ethics in the business decision process and the types of ethical issues business practitioners face in the business environment; consequentialist and nonconsequentialist ethics principles and their application to business decision-making; the role of personal and organizational values in business decision-making and the impact that organizational culture has on the ethical dimension of decision making. Students will evaluate and analyze the ethical dimension of decision-making; become familiar with the stakeholder concept and utilize it in the business decision-making process; identify the constraints societal values place upon the firm; examine the role government plays in the marketplace; explore the social and ethical

dilemmas that arise from the globalization of business; and understand and explain the process through which corporations attempt to influence societal and government institutions.

Prerequisite: B A 517 , MGMT 501

BUSAD 578: Managing Business Processes

3 Credits

Develop and evaluate process models, performance metrics, and information flow to facilitate cross-functional business processes for 21st century organizations. BUSAD 578 Managing Business Processes (3) Twenty-first century executives cross-functional business processes rather than managing their organizations as independent functional silos. Consequently, the ability to design and implement process oriented organizations has considerably evolved over the past decades. More importantly, initiatives related to Service Oriented Architectures (SOA) and Business Process Management (BPM) systems are predicated on the existence of well-designed business processes. However, the task of designing processes has become harder due to the disappearance of boundaries both within and across enterprises. Managing Business Processes provides students with an understanding of the key aspects of business processes such as collaboration, information flow, people, and business rules. The main objective is to provide an overview of various techniques and tools for analyzing, improving, and implementing business processes and information system controls. The course will utilize cases, process modeling methodologies, and simulations to strengthen the students' understanding of business processes and their contribution to business performance.

Prerequisite: ACCTG 800 or BA 810

BUSAD 801: Statistical Analysis for Managerial Decision Making

3 Credits

This course is designed to provide the M.B.A. students with an exposure to the most commonly used statistical concepts, methods, techniques, and their applications to business problems. This course covers the basic concepts of business statistics and data analysis integrated in a contemporary spreadsheet environment. The course emphasizes practical applications and business decision making.

BUSAD 802: Cornerstone of Sustainability

3 Credits

In-depth exploration of the social, environmental, and organizational sustainability challenges facing business leaders in the 21st Century. BUSAD 802 Cornerstones of Sustainability (3) BUSAD 802 provides students with an overview of the social, environmental, and organizational sustainability challenges facing 21st Century business leaders. The course seeks to develop students' critical capacities for reflection and action based upon a systems thinking framework. Topics to be explored include the history of the sustainability movement, an overview of pressing environmental and social issues, and alternative perspectives on the local and global economy. The course addresses local and global issues surrounding sustainable management and reviews the major frameworks of sustainability that provide the scientific foundations and economic principles of how sustainability can help organizational leaders to achieve natural competitive advantage. Students will apply theoretical and practitioner frameworks to real world cases.

BUSAD 809: Triple Bottom Line Accounting

3 Credits

In-depth exploration of the issues related to implementing measurement, reward and reporting systems for economic, social, and environmental impacts. BUSAD 809 Triple Bottom Line Accounting (3) BUSAD809 expands the traditional financial and managerial accounting topics to encompass economic, social, and environmental impacts. Students will investigate the strategic linkages between sustainability and the value of the organization, define true costs and become familiar with alternative cost measurement systems, and assess the impact of social risk. Other topics include the design and implementation of management performance evaluation and reward systems that align with social and environmental as well as economic goals, and global reporting standards and best practices.

BUSAD 811: New Ventures Ideation and Feasibility Analysis

3 Credits

BUSAD 811 focuses on the ideation process and determining whether an idea has commercial potential in both an entrepreneurial and intrapreneurial setting. In order to see and evaluate opportunities, students learn about entrepreneur characteristics; develop skills such as marshaling resources (HR, legal, financial, operational, and technical) needed to introduce the product or service into the market place; and developing an entrepreneurial team.

RECOMMENDED PREPARATIONS: 6 credits in business or by permission

BUSAD 819: Developing Creative High Performance Organizations

3 Credits

This course focuses on how to create high performing organizations based on models provided by business, science and the arts. We will examine the key assets that these disciplines bring and show how to apply them to business activities. For example, it has been shown that improvisational models from music are highly relevant to new product development. Course activities will include a discussion of the readings from relevant academic research in the business field. We will discuss the philosophy of aesthetics, analyze cases, and review original works. We will also listen to short lectures by practicing artists, musicians, actors, scientists, and writers. Together, these activities will help students to develop strategies to help their organizations attain higher levels of performance. This course is a graduate elective for MBA students and could also be taken by other students (such as Leadership students) if it meets their degree requirements. The way the course will run: This course will be run as a graduate seminar designed to maximize the learning of the members of the group including the instructor's. We will learn about each of the topics noted above through a variety of means. Our interaction will include general discussions, lectures, case discussions, exercises, small group meetings, and on-line chats. We will have invited speakers for the class representing the arts, music, science and business.

Prerequisite: 6 graduate credits in business

Cross-listed with: LEAD 819

BUSAD 822: New Venture Start-up

3 Credits

Examines the financial and legal issues that are critical in the formation, development, and management of new ventures. The focus of the

course is on the methods of funding and cash flow management for the new enterprise, as well as the underlying legal issues that impact new ventures. This course builds on the foundation of the required finance course to give students an overview of the various legal issues that are critical to new venture development.

RECOMMENDED PREPARATION: 6 credits in business or by permission

BUSAD 824: Finance and Investment for Sustainable Growth

3 Credits

In-depth exploration of the methods of financing available for sustainable growth in developed and emerging markets. BUSAD 824 Finance and Investment for Sustainable Growth (3) BUSAD 824 provides students an in-depth exploration of the theories and the applications that financial professionals can leverage to simultaneously earn a profit and have a positive impact on society. The specific financial sectors students will examine are: Capital Markets (to address environmental issues), Commercial Banking (to create sustainable economic development), Project Finance (to reduce poverty and create infrastructure development), and Investment Management (to understand and employ socially responsible investing).

BUSAD 826: Current Issues in Corporate Finance

3 Credits

This course covers topics in advanced corporate finance and financial modeling, including capital structure, cost of capital, financial forecasting, and valuation. Estimating the firm's current market value and projecting its future performance requires one to build accurate and flexible financial models. The ability to understand and build financial models is one of the most essential skills in the finance field, including commercial banking, corporate financial management, investment management, and investment banking. This course bridges the gap between theory and real-world practice through a step by step hands-on approach in financial modeling.

Prerequisite: BA 831, BUSAD 525, ACCTG 512

BUSAD 827: Fixed Income Securities

3 Credits

This course focuses on the various fixed income securities including bonds (treasury, corporate, municipal), mortgage-backed securities, asset-backed securities, interest rate derivatives, and credit derivatives. It will build upon that knowledge in order to understand fixed income portfolio management, with focus on portfolio construction, managing versus a benchmark, and measuring and managing risks.

Prerequisite: FIN 813

BUSAD 828: Mergers and Acquisitions

3 Credits

The mission of this course is to survey the drivers of success in mergers and acquisitions (M&A) and develop students' skills in the design and evaluation of these transactions. The course will combine a survey of mergers and acquisitions, an investment banking product-training class for associates, and a case study. We will focus on the type of merger most class participants will potentially be involved with - the acquisition of a modest-sized private company by a larger private company, or by a mid-size public company. At the same time, due to the availability of date,

much of the case material relates to larger public-to-public transactions. We will use these cases to illustrate major points applicable across a range of transactions.

Prerequisite: ACCTG 512

BUSAD 829: Data Analysis in Finance

3 Credits

Financial markets produce huge amounts of data, which poses a big challenge for financial institutions. This course provides students with the necessary knowledge and skills to analyze financial data to extract valuable insights in order to facilitate financial decisions. This course focuses on how statistical methods and data mining techniques can be used to analyze real financial data.

Prerequisite: BUSAD 525

BUSAD 830: Biotechnology and Health Industry Overview

3 Credits

The course explores current issues and trends in the biotechnology, pharmaceutical, medical device, and health care industries. The classic cost, quality, and access paradigm is applied from the perspective of multiple stakeholders. Organization of care, financing, policy, regulatory, and ethical problems and issues are emphasized.

BUSAD 834: Ethical Dimensions of Management in the Biotechnology and Health Industry

3 Credits

This course provides an overview of various ethical decision-making frameworks, which are then applied to critically examine issues within the biotechnology and health industries. Ethical decision-making frameworks include utilitarian principles, rights and justice theories, virtue ethics, feminist ethics, and various medical ethics models. Applications to cases involving genetic testing, stem cell research, euthanasia, organ retrieval and transplantation, and pharmaceutical development are among those to be explored. BUSAD 534 BUSAD 534. Ethical Dimensions of Management in the Biotechnology and Health Industry (3) BUSAD 534 introduces the students to various ethical decision-making frameworks, which are then applied to critically examine issues within the biotechnology and health industries. Ethical decision-making frameworks include utilitarian principles, rights and justice theories, virtue ethics, feminist ethics, and various medical ethics models. Applications to cases involving genetic testing, stem cell research, euthanasia, organ retrieval and transplantation, and pharmaceutical development are among those to be explored. Teaching methods include faculty lectures, case study analysis, small group and class discussions, and industry guest speaker presentations. Students will be evaluated on the quality of individual and team writing assignments as well as a team oral presentation. The course will be offered twice annually by the Penn State Great Valley School of Graduate Professional Studies' MBA program and is a required course in the Penn State Great Valley MBA program option biotechnology and health industry management.

PREREQUISITE BUSAD 830

BUSAD 835: Commercialization of Biopharmaceuticals

3 Credits

Review organizational processes, regulatory, and environmental issues in the development and commercialization of biopharmaceuticals in the United States and globally. BUSAD 835 Commercialization of Biopharmaceuticals (3) This course reviews organizational processes, regulatory, and environmental issues in the development and commercialization of biopharmaceutical products in the United States and globally. Business development strategies and tactics that encourage innovation and enable biopharmaceutical organizations to prosper in changing business environments are emphasized. The regulatory environment globally and nationally is reviewed for its impact on biopharmaceutical discovery and commercialization, including the IND (investigational new drug) and NDA (new drug application) process and quality control/assurance. Organizational dynamics including culture, structure, ethical dimensions of management, and special considerations in global marketing are explored. Marketing and brand management, financial forecasting, and structuring sales and marketing are examined for their impact on successful commercialization of biopharmaceutical products.

Prerequisite: BUSAD530**BUSAD 837: Managing Digital Enterprises**

3 Credits

This course addresses the ways digital technologies transform industry, business models, strategies, operations, and management, and create new markets and products. The competitive advantage module builds on how technological and organizational resources interact to create sustainable competitive advantage. The technology infrastructure and architecture module focus on understanding the core tenets of a digital enterprise and how technology decisions affect the different functional areas of the organization. The Implications of data module focuses on the collection, analysis, and use of massive amounts of data driven by digital technologies. The topics covered include big data, search and ad technologies, health, and current/emerging topics. The Transformational Impact module discusses how technology can create new platforms and marketplaces

BUSAD 843: People Analytics

3 Credits

This course develops students' process modeling, data analytics, and decision-making skills regarding the management of people in an organization. Analytics includes data collection, organization, storage, analysis, and all the tools and techniques used to describe current processes, assess and address challenges, and plan for changes. Before managers can make use of people analytics, they must understand and describe human resource processes as well as the relevant databases, information systems, and other information and resources available. Students in this people analytics course will develop an understanding of traditional work processes, HR management requirements, and HR information system architectures in the context of data-driven approaches to decision-making about people in organizations. Students will learn to model HR processes, develop queries, analyze data, and generate reports to make strategic decisions in areas of HR practice such as selection, compensation, performance evaluation, productivity management and enhancement, training and development, and occupational health. Students will also learn to use process and outcome

metrics to evaluate business outcomes and to assess diversity, equity, and inclusion goals as well as other strategic initiatives. Some hands-on work will be required. This will consist of a series of exercises to be used with an employee database. A series of managerial questions will be provided which can be answered utilizing this database. Students will develop approaches towards answering some of these questions and then seek answers in the database. Students will propose their own answers to at least two of these exercise questions. Students will also have the opportunity to model a real-world management challenge and evaluate the analytical techniques that would be used to reach an outcome or decision. Overall, students will cultivate a leadership perspective that values and practices evidence-based decision-making, develop a deeper understanding of how people data associated with HR processes can increase the likelihood of success for organizational change efforts, and enhance their analytical skills by evaluating people data and by interpreting and meaningfully communicating findings.

Recommended Preparation: Successful completion of a graduate-level statistics course or provide evidence of professional credentials to demonstrate basic knowledge of applied statistical tools and methods prior to enrolling in this course.

BUSAD 855: Full Range Leadership Development

3 Credits

Leadership is one of the world's oldest preoccupations. Since the beginning of civilization, prophets, kings, rulers and managers have struggled to find answers to an important question: Why do most leaders or managers elicit merely competent performance from their followers, while a select few inspire extraordinary achievement? Given increased globalization, diversity, restructuring, e-business and innovation in today's business environment, finding answers to this question is important for maintaining organizational competitiveness. The purpose of this course is to provide answers to this question by identifying traits and behaviors associated with outstanding leaders, explaining how they get results, and why their leadership often exceeds all expectable limits. This course is designed to introduce students to a) behaviors associated with outstanding leadership, b) social learning and cognition in organizations as a context to promote outstanding leadership, and c) leadership development as a strategic intervention to enhance individual, group, and organizational motivation and performance. The course will be run as a graduate seminar. We will interact through Web site technology, general group discussions, team projects, lecturettes, case discussions, exercises and videos. Class sessions will focus on issues raised by the readings, cases, and issues relevant to students' organizational experiences. A portion of the class time may be set aside for the coordination of team projects.

Prerequisite: MGMT 501 or LEAD 501

Cross-listed with: LEAD 855

BUSAD 856: Diversity Leadership

3 Credits

In this course students will explore the theory and practice of diversity leadership through experiential exercises, video and didactic presentations, small group and class discussions, and the analysis and application of models, theories, and strategies for managing an increasingly diverse workforce and customer base.

Prerequisite: LEAD 501 or MGMT 501

Cross-listed with: LEAD 856

BUSAD 859: Career Management

3 Credits

This course is based on the expressed need of many adult graduate students to understand themselves and their careers, to develop the skills necessary to manage their careers effectively throughout their lifetimes, and to help subordinates manage their own careers. Many adult learners are at a critical stage in their careers, with significant decisions regarding job search, career change, managing work-family demands, and/or dual-career relationship concerns. This course is designed to help these students understand these and other career challenges. The Career Management course provides students with a conceptual understanding of careers and career decision-making through an examination and discussion of the literature in career management. Additionally, a significant focus is placed on application of the concepts to understand the student's own career, as well as the careers of supervisors, peers, and subordinates through various diversity, equity, and inclusion lens. This course will blend both conceptual analysis and experiential learning activities focused on helping adult learners understand 21st century careers.

Recommended Preparations: Admission to a graduate degree program or a graduate certificate program, or advisor/instructor approval.

BUSAD 876: Ethical Issues in Information Technology

3 Credits

Computers are the technological foundation of the information age. Well over half of workers in the U.S. and around the globe make their living by collecting, storing, and manipulating data. Technology has improved our lives, but has also created some unpleasant situations that raise serious ethical questions. The course explores important ethical issues that are affected by information technology, such as privacy, free speech, computer crime, intellectual property, IT professionalism, and software product liability.

PREREQUISITE BUSAD 537

BUSAD 879: Sustainable Supply Chain Management

3 Credits

In-depth exploration of sustainability of manufacturing and supply chain operations. BUSAD 879 Sustainable Supply Chain Management (3) BUSAD 879 provides students a set of tools and skills to identify, evaluate, and improve the sustainability of manufacturing and supply chain operations. This course enables students to understand the core concepts related to both supply chain and sustainability. After taking this course, students will be able to design sustainable manufacturing, transportation and supply chain operations. The emphasis in this course is on the design and operations of supply chains to minimize their environmental footprint. Students will also learn how to evaluate suppliers' sustainability to assign purchasing contracts to minimize the environmental impact. Other important concepts such as product remanufactureability design and techniques to reduce energy usage and raw materials will also be discussed.

Prerequisite: BA 810

BUSAD 882: Social Entrepreneurship and Community Leadership

3 Credits

This course uses entrepreneurial and leadership skills to craft innovative responses to social needs. Entrepreneurs are particularly good at recognizing opportunities, exploring innovative approaches, mobilizing resources, managing risks, and building viable, sustainable enterprises. Entrepreneurial skills are just as valuable in the social sector as they are in for-profit business. Social Entrepreneurship aims at social impact but does not exclude economic wealth creation. Therefore it is not limited to the non-profit sector. Despite a sustained economic boom in this country, numerous social problems remain and some seem to be getting worse. The course will provide an overview of business leadership and entrepreneurship principles for both profit and non-profit organizations whose products and services are designed to create social value.

Recommended Preparation: Completion of 24 credits in the MLD program for MLD students; Other programs 6 graduate credits or by permission of instructor.

Cross-listed with: LEAD 882

BUSAD 885: Research in Security Valuation

3 Credits

This course focuses on the analysis and valuation of a firm's equity securities in the financial market using a fundamental analysis. Students will learn how to use different valuation techniques for different types of companies (e.g., companies in financial distress/bankruptcy, private companies, start-up companies with no earnings). The course integrates topics discussed in various finance courses to help students to develop their analytical ability to identify strategies that enhance value creation. The philosophical basis for this topical integration is that valuation of a firm's securities requires one to know not only the accounting issues involved in the preparation of financial statements and how to analyze financial statements, but also to understand the impact of monetary policy, the operation and regulation of financial markets on the value of the firm's equity securities. Moreover, because firm value depends on how well the company is managed, a good understanding of its operations in the global markets, its internal control and risk management strategy is also essential. Finally, because valuation is also based on quantitative models, knowledge of quantitative methods is paramount.

Prerequisite: completion of all core courses in the Master of Finance program

BUSAD 888: Applications of Financial Data Analytics

3 Credits

This course is the capstone course for the financial data analytics option of the MFIN program. After students acquire different techniques and knowledge from other courses, including financial data processing, data cleanup, data mining, and other statistical analysis skills, they will apply these concepts in this course to do case analysis related to real-world applications.

Prerequisite: BA 831, ACCTG 512, BUSAD 525, FIN 808, BUSAD 826, FIN 813, BUSAD 829, IE 575, and SWENG 545

Business Analytics (BAN)

BAN 550: Prescriptive Analytics for Business

3 Credits

Development of methods for prescriptive analytics with a focus on business supply side decisions and risk mitigation. BAN 550 Prescriptive Analytics for Business (3) Analytics, defined as the scientific process of using data and quantitative techniques to make better decisions, has permeated virtually all aspects of business. The widespread availability of large amounts of detailed data combined with analytics methods permits an extensive examination of the tradeoffs that inform business decision making, with the ultimate goal of choosing "best" courses of action. BAN 550 explores the use of prescriptive analytics methods in a variety of business contexts. In the early part of the course, the focus is on the tools and methods of prescriptive analytics. As the course progresses the emphasis shifts to the effective integration and implementation of prescriptive analytics in supply-side decision making processes such as supply chain management, service management, operations, logistics and transportation. The applications areas within business will reflect the interests of the instructors and will evolve as new areas of theory and practice develop.

Prerequisite: BAN 840

BAN 830: Descriptive Analytics for Business

3 Credits

BAN 830 explores the use of descriptive analytics concepts, tools, and techniques throughout a wide range of business scenarios and problems. Initially focusing on the application of traditional descriptive analytics techniques to answer the question, "What happened?," the course provides opportunities for students to perform spreadsheet- and programming-based data acquisition, cleaning, manipulation, and visualization using data derived from various business contexts to inform business leaders' decisions. Later, students progress to applying advanced statistical techniques and concepts including descriptive measures, sampling and estimation, and inference in both spreadsheet and programming environments. The course concludes with a bridge to predictive analytics as students apply linear and multiple linear regression to business-related data in search of relationships among input and output variables. Software packages, concepts, and business applications will vary and evolve to keep pace with technology, theory, and instructor interests.

BAN 831: Business Data Visualization for Decision Making

3 Credits

Given society's ever-expanding ability to collect and store vast amounts of transactional, performance, and financial data, business analysts and leaders need the capability to recognize patterns in and transform raw data into actionable business intelligence. Designed for recent graduates with little to no professional experience, BAN 831 expands upon the data visualization concepts covered in BAN 830 by exploring a variety of advanced data visualization techniques focused on "big data" sets derived from marketing, finance, accounting, supply chain management, and other business-related scenarios. Using the latest data visualization software applications, business students will focus on the development of dashboards and scorecards useful for translating structured and unstructured business performance data into decision-ready knowledge. The course will prepare business analysts by exploring techniques for

visualizing data from sales transactions, social media, marketing surveys, financial records, and other sources in support of fact-based decision making. An emphasis will be placed on the nuances specific to decision making in various business areas. Software packages, concepts, and business applications will vary and evolve to keep pace with technology, theory, and instructor interest.

BAN 832: Programming Skills for Business Analytics

3 Credits

Designed specifically for recent graduates with 0-5 years of practical experience, BAN 832 gives business students the foundational programming skills they need to leverage the power of leading edge general purpose programming languages to acquire, clean, manipulate, query, visualize, and analyze large data sets typical of a variety of business environments. With a focus on developing solutions to business data problems, students will become conversant with a variety of software applications in the context of financial, marketing, supply chain management, and other data-rich business scenarios. Coursework includes individual assignments intended to develop dexterity with foundational programming skills, followed by case-based problems that challenge students' creativity and programming mastery in search of solutions to complex business problems. This course aims to put recent graduates on the same level as more experienced analysts with regard to applying programming skills and implementing widely used algorithms to solve business analytics challenges. Previous programming experience is helpful but not required, and students will have the opportunity to augment their learning with additional online tutorials. Software packages, concepts, and business applications will vary and evolve to keep pace with technology, theory, and instructor interest.

BAN 840: Predictive Analytics for Business

3 Credits

BAN 840 explores the use of predictive analytics tools and techniques throughout a wide range of business scenarios and problems. Initially focusing on the application of traditional predictive analytics techniques to answer the question, "What will happen in the future?," the course provides opportunities for students to apply regression and forecasting techniques to data from various business contexts to inform business leaders' decision. Later, students explore various software applications and techniques for acquiring, preparing, and analyzing "big data", recognizing and taking advantage of the exponential growth in the amount of structured and unstructured data generated by and available to businesses. The course next examines cutting-edge techniques gaining increased attention among analytics experts, including data mining, text analytics, and social media analytics. Finally, students will be given an overview of the future of predictive analytics, developing an awareness of artificial intelligence and machine learning concepts, such as neural networks, to help them advance their organizations' business analytics capabilities. Software packages, concepts, and business applications will vary and evolve to keep pace with technology, theory, and instructor interests.

Prerequisite: BAN 830

BAN 841: Data Mining for Business

3 Credits

Intended for recent graduates with little to no professional experience, BAN 841 develops business students' understanding of and ability to

apply a variety of data mining tools and techniques for use in detecting and exploiting patterns and relationships in large structured and unstructured data sets derived from a variety of business scenarios. Students will explore the use of cluster analysis, classification, association, and cause-and-effect modeling techniques to explore and reduce data, classify new data elements, identify natural associations among variables, create rules for target marketing or buying recommendations, and describe relationships among data that motivate business performance. Specific techniques may include k-nearest neighbor, discriminant analysis, and association rule mining. Students will learn how to bridge descriptive and predictive analytics across a variety of business scenarios. Coursework includes individual assignments intended to develop confidence with basic data mining techniques, followed by case-based problems that challenge students' creativity and data mining mastery in search of patterns and data relationships leading to useful business insights. While underlying theory will be discussed, the course will prepare business analysts by focusing specifically on data mining applications in marketing, finance, supply chain management, and other business areas, with an emphasis on the unique aspects of decision making in a business environment. Software packages, concepts, and business applications will vary and evolve to keep pace with technology, theory, and instructor interest.

BAN 888: Implementing Analytics for Business

3 Credits

Sets business analytics in real-world context. Explores project life cycle from business problem framing to model lifecycle management. BAN 888 Implementing Analytics for Business (3) The capstone course for the Business Analytics option in the Data Analytics MPS degree program, this course sets analytics problem solving in a real-world context, including communication to non-statistically trained executives. Key topical areas are derived from the common activities of the business analyst and include business problem framing, analytics problem framing, data sourcing, cleaning and integration, analysis methodology selection, model building, model deployment and model lifecycle management including benefit assessment. Topics align with the body of knowledge in the Institute for Operations Research and the Management Sciences (INFORMS) Certified Analytics Professional Study Guide. Students explore each topic in a real world context, by developing solutions to cases in a team setting. Each team selects a case and works through all elements of the analytics body of knowledge, with group presentations on problem framing, analytics model selection and development, and model lifecycle management in a business setting.

Prerequisite: BAN 530 and BAN 550

Business Economics (BUSEC)

BUSEC 502: Economics for Managers

3 Credits/Maximum of 999

Demand & supply; price and output determination in different markets; determination of income, employment, interest rates, and inflation; stabilization policy. The course consists of two main segments: Microeconomics and Macroeconomics. The course begins with basic economic principles of price and output determination in markets. Students will get an understanding of cost structures of firms in the short and long run, and how firms choose to operate. With this foundation, students will proceed to examine market structure, which is the nature of competition among firms, ranging from perfect competition (many non-

dominant suppliers) to monopoly (one dominant market supplier). While studying firms in different market structures, most of the focus will be on business firms which have some market power: monopolistic competition and oligopolies (a small number of inter-dependent suppliers). Strategic behaviors of firms and different oligopoly models will be studied in detail. Business firms operate within an economic environment that provides opportunities, constraints, and threats. The second part of the course focuses on the economic environment over time, generally described as the business cycle. The course will begin considering business cycles by looking first at main indicators such as growth of real GDP (Gross Domestic Product), unemployment rates, and inflation rates. Students will employ simple models of the business cycle to explain recessions, inflation, and other environmental conditions. Financial markets are important in determining economic conditions. Students will learn about the role of financial markets in determining availability and costs of funds. Economic policy is the effort of government to change the economic environment. An important part of the course is the study of these policies. Fiscal policy consists of the use of taxation and government spending to shape the environment. Monetary policy is the effort to influence credit conditions and interest rates for the purpose of achieving a specific environmental change. Domestic economic conditions are increasingly shaped by global conditions. Therefore, a part of the course will be devoted to analysis of foreign exchange rates, interest rates, and monetary policies of other countries. In addition, students will analyze the impacts of barriers to international trade (primarily quotas, tariffs, and foreign exchange controls) and investment.

BUSEC 503: Economic Environment of Business

2 Credits

Analysis of the regulatory and global economic environment within which the firm operates and its implications for business strategy. BUSEC 503 BUSEC 503 Economic Environment of Business (2) Most courses in the School's M.B.A. program focus on managing the individual firm. However, business firms operate within an economic environment that provides opportunities, constraints, and threats. This course enables the firm's decision-makers to assess this environment and to design strategies that are appropriate for conditions in the firm's global, domestic, or regional spheres of operation. The path of changes in the economic environment over time is generally described as the business cycle. The course begins with consideration of business cycle indicators, such as growth of real GDP, unemployment rates and inflation. Students employ simple models of the business cycle to explain recessions, inflation, and other environmental conditions. Class discussions will include consideration of appropriate managerial decisions under each of a variety of these conditions. Financial markets are important in determining economic conditions. Students learn how the interest rate yield curve and other financial market indicators give insight into expectations about credit conditions and economic change. Financial markets also play important roles in determining availability and costs of funds. Economic policy is the effort of government to change the economic environment. An important part of the course is the study of these policies. Fiscal policies consist of the use of taxation and government spending to shape the environment. Monetary policy is the effort to influence credit conditions and interest rates for the purpose of achieving a specific environmental change. Domestic economic conditions are increasing shaped by global conditions. Therefore, a significant part of the course is devoted to analysis of foreign exchange rates, interest rates, and monetary policies of other nations. In addition, students will analyze the impacts of barriers to international trade (primarily quotas and tariffs and foreign exchange controls) and investment. The course concludes with examination of

government regulation and its effect on business. Many regulations are designed to counter-act negative external effects of decisions made by private profit-pursuing firms, especially with regard to pollution of the natural environment. Anti-trust policies, patent and copyright laws. These regulations provide constraints and opportunities for business managers. Students demonstrate achievement through completion of short cases, class discussions, and an examination.

Prerequisite: admission to the MBA program or the MSIS program

Business Law (BLAW)

BLAW 525: Business Law for Innovation and Competition

2 Credits

Nature of intellectual property rights, as well as process for obtaining and enforcing them. BLAW 525 Business Law for Innovation & Competition (2) Primary areas of focus include intellectual property (IP) law (patents, trademarks, copyrights and trade secrets) and antitrust law, as well as basic principles of U.S. law and the legal rules for related industry practices such as licensing. Students will also learn the legal rules designed to encourage competition (and punish anticompetitive behavior). Finally, the course will help students to better appreciate when professional legal counsel is necessary, and how to manage those interactions more cost effectively. Although the course will impart advanced legal concepts, prior coursework in business law is not required.

BLAW 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

Cell and Molecular Biology - MD (CMBIO)

CMBIO 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

CMBIO 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

Prerequisite: ANAT 505

CMBIO 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

CMBIO 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

Chemical Engineering (CHE)

CHE 501: Bioengineering Transport Phenomena

3 Credits

Application of the equations of mass, energy, and momentum conservation to physiological phenomena and to the design of artificial organs.

Cross-listed with: BIOE 501

CHE 503: Fluid Mechanics of Bioengineering Systems

3 Credits

Cardiovascular system and blood flow, non-Newtonian fluid description, vessel flows, unsteady flows and wave motion, windkessel theory, transmission line theory.

Prerequisite: BME 409 (equivalent to CH E 330, M E 320, or AERSP 308)
Cross-listed with: BIOE 503

CHE 505: Atomistic Scale Simulations for Engineer

3 Credits

This course aims to provide an overview of atomistic-scale methods - in particular, ab-initio based methods like Density Functional Theory and empirical force field methods - to an engineering audience. Due to the increasing availability of computers, atomistic-scale simulation methods are becoming increasingly relevant to engineers, as they can provide key thermodynamic and material properties necessary for the design and analysis of engineering material performance. The main aim of the course is to encourage students to integrate atomistic-scale concepts in their current research. As such, there is a strong emphasis on hands-on experience with various software codes, including commercial codes and academic codes. The students learn the basic concepts of quantum mechanics, statistical thermodynamics, crystallography, physics and chemistry as they relate to ab initio and empirical force field methods and their integration in energy minimization, molecular dynamics and Monte Carlo methods. These concepts are discussed on a conceptual level, enabling students to understand their application range and validity. Furthermore, we dedicate a significant amount of class time to engineer-relevant applications of these force engines and methods.

Cross-listed with: ME 505

CHE 510: Surface Characterization of Materials

3 Credits

Physical and chemical principles of characterization techniques widely used in materials science, chemistry and engineering. CH E (MATSE) 510 Surface Characterization of Materials (3) Surface and interface characterization is an important subject in nanotechnology, heterogeneous catalysis, semiconductor processing, advanced functional materials, biomaterials, corrosion, environmental science, and tribology. This course will study the physical and chemical principles of representative characterization techniques widely used in these research

areas. Topics covered in this course include surface chemistry and physics fundamentals, x-ray and electron-based spectroscopy, vibration spectroscopy, ellipsometry, microscopy with physical probes, and multivariate data analysis. Physical principles and practical applications will be studied through theoretical calculations, data analysis, and literature reviews.

Cross-listed with: MATSE 510

CHE 512: Optimization and Biological Networks

3 Credits

Mathematical optimization, formulation and solution techniques for linear, nonlinear, and mixed-integer problems; optimization-based tools for reconstruction, analysis, and redesign of biological networks. CHE 512 Optimization and Biological Networks (3) This course focuses on the principles and applications of mathematical optimization in biological systems. The first part of the course addresses optimization theory, solution algorithms, and implementation software. Topics include nonlinear optimization, linear programming, mixed-integer linear and nonlinear optimization, and bi-level optimization. Emphasis will be placed on understanding the logic of the methodology, underlying key assumptions, comparative merits and shortcomings, and applications for solving engineering problems. Valuable hands-on experience will be provided on coding optimization models using GAMS (General Algebraic Modeling System) and specialized optimization solvers. The latter part of the course concentrates on applying the tools necessary to address the challenges arising in biological networks. Specifically, the use of optimization in reconstructing and analyzing genome-scale models of metabolism, protein library design strategies, regulatory network elucidation, and synthetic circuits design as well as optimal modifications in metabolic networks for various bioengineering tasks will be studied.

CHE 515: Density Functional Theory and Practice

3 Credits

This course gives students an overview of the theory and practice of calculations performed with Density Functional Theory (DFT). DFT is a powerful tool to calculate the structural and electronic properties of collections of atoms. The course emphasizes the practical aspects of the calculations and the theory will be only described as necessary to understand and perform correct calculations. The target audience of the course is students of Physics, Chemistry, Materials Science, Chemical or Mechanical Engineering, and other science/engineering disciplines that need to learn to perform calculations based on DFT with a minimum of exposure to the theoretical details underlying this technique.

Cross-listed with: PHYS 515

CHE 520: Polymer Science and Engineering

3 Credits

This course provides fundamental understanding of basic principles in polymer science and connects these to current research topics at Penn State as well as novel findings in soft material science at other institutions. Interdisciplinary in content, the curriculum spans from polymer synthesis (chemistry), to physical properties (physics), to characterization, to engineering (chemical engineering), to application of polymer materials (materials science). Two areas of focus will lie on (i) the environmental impact of commodity plastics and (ii) conductive polymers and their every-day use in display technology and energy harvesting. While polymers are versatile and broadly applicable, there lie

significant dangers in their use for us as a society. For example, while the drive for flexible displays and solar cells is increasing, there is no clear pathway for efficient recycling of the resulting electronic polymeric materials. To this end, this course will engage students in discussions about industrial processing of polymers and the importance to find new pathways for their recycling.

Cross-listed with: CHEM 520, MATSE 520

CHE 524: Chemical Engineering, Application of Thermodynamics

3 Credits

Elements of thermochemistry and thermodynamics of greatest importance in chemical engineering.

CHE 528: Colloidal Forces and Thermodynamics

3 Credits

Unified treatment of formation, growth and stability of colloids based on principles of intermolecular and colloidal forces and thermodynamics.

Prerequisite: CHEM 450, CHE 320 or an equivalent background in chemical thermodynamics

CHE 535: Chemical Reaction Engineering

3 Credits

Optimal design of batch and continuous chemical reactors and reactor batteries; effect of mixing on reactor operation.

CHE 536: Heterogeneous Catalysis

3 Credits

Thermodynamics and kinetics of adsorption and reactions on solid surfaces, heat and mass transfer effects, theory and correlations in catalysis.

Prerequisite: CHEM 450, CHEM 452

CHE 544: General Transport Phenomena

3 Credits

Formulation and solution of transport problems involving momentum, heat, and mass transfer, with chemical engineering applications.

Prerequisite: CHE 330, CHE 350, CHE 410

CHE 546: Transport Phenomena II

3 Credits

Heat and mass transfer, steady and unsteady state, coupling, molecular diffusion, moving boundaries, transfer coefficients, chemical engineering applications.

CHE 555: Engineering Soft Materials

3 Credits

Soft materials are materials that can be easily deformed by thermal stresses or thermal fluctuations at about room temperature. In this course, the foundations of soft matter will be explained using numerous real-life examples. A comprehensive overview on different types of soft matter, such as polymers, colloids, gels, liquid crystals, amphiphiles,

proteins, and/or cells will be provided, and the focus will be placed on engineering this burgeoning class of materials to address current challenges in the food-water-healthcare-energy nexus. During the semester, students will be guided to learn about various classes of soft materials and discover their emerging applications to address some of the quintessential challenges of the 21st century.

Recommended Preparation: Basic knowledge of thermodynamics, physical chemistry, and mathematics will be helpful.

CHE 576: Environmental Transport Processes

3 Credits

Fundamentals of chemical transport in engineered environments, such as biofilm reactors, and natural systems including aquifers and rivers. C E 576C E 576 Environmental Transport Processes (3) Environmental Transport Processes covers the fundamental of mass transport of chemicals between air, water, soil, and biota. Material is divided into three subject areas: mass transfer theory, transport processes related to engineered reactors, and transport in the natural environment. The focus of the course is on chemical calculations particular to dilute systems, with emphasis on quantifying chemical transport rates and distributions in natural and engineered environments. Special topics of interest to environmental engineers include biofilm models, bioreactors, chemical partitioning in thin fluid film bioreactors, and fate of anthropogenic chemicals from spills and discharges into the environment (i.e., rivers, lakes, and groundwaters). Faculty: Bruce E. Logan

Prerequisite: C E 475

Cross-listed with: CE 576

CHE 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

CHE 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

CHE 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

CHE 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

CHE 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

CHE 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Opportunity for supervised and graded teaching experience for graduate students in chemical engineering.

Prerequisite: At least one year of graduate study in chemical engineering.

CHE 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

CHE 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

Chemistry (CHEM)

CHEM 500: Seminar in Chemistry

1 Credits/Maximum of 99

No description. CHEM 500 CHEM 500 Seminar in Chemistry (1) CHEM 500 is a course in which 1st and 2nd year Chemistry graduate students write about and present a seminar on current chemical research. During their first year of graduate study students are asked to write 6 or more brief reports summarizing and critiquing designated seminars in one of the department's five regular seminar series. These reports are graded for both their scientific content and writing quality. During their second year of graduate study students are asked to write a more lengthy report and give an oral presentation on a topic of current interest in chemistry, but one not closely related to research being done at Penn State. The written and oral portions of this exercise are also graded. Faculty: Andrew Ewing and Mark Maroncelli

CHEM 504: Numerical Methods for Chemists and Engineers

3 Credits

CHEM 504 is a 3-credit course designed to give graduate students an overview of basic numerical techniques. After completion of the course, the students will be able to perform simple computational tasks. The emphasis will be given to numerical solutions of ordinary and partial differential equations relevant to the chemical and biomedical research, such as reaction kinetics and transport phenomena. This 500-level course will contribute to the student's ability to expand the frontiers of knowledge, to perform independent research, work as a team, and make conference-style presentations.

Recommended Preparations: Working knowledge of calculus and familiarity with Matlab.

Cross-listed with: BME 504

CHEM 511: Chemical Nanoscience

3 Credits

Chemical aspects of matter at the nanoscale. CHEM 511 Chemical Nanoscience (3) This course covers chemical aspects of nanoscience. Topics to be covered include how nanoscale matter differs from bulk material; strategies for synthesis, characterization, purification, and chemical functionalization of nanostructures; forces involved in

nanoparticle stabilization and assembly. Emphasis will be placed on wet chemical methods of nanostructure syntheses rather than traditional top-down nanofabrication. Properties of the resulting nanomaterials of interest for uses including biology and medicine, environmental remediation, electronics, optics, catalysis and solar energy conversion will be discussed. The course will emphasize both the primary scientific literature and review articles, and assumes prior knowledge of organic and physical chemistry.

Prerequisite: CHEM 452 and either CHEM 450 or CHEM 466

CHEM 516: Inorganic Chemistry

3 Credits

Overview of systematic inorganic chemistry including main group, transition metal, lanthanide, and actinide chemistry. CHEM 516 Inorganic Chemistry (3) The purpose of this course is to provide a graduate level foundation in the field of inorganic chemistry and its relationship to other areas of science and technology. The emphasis will be on atomic and molecular structure, synthesis methods, and structure-property relationships in a way that will prepare students for studies in more specialized areas such as environmental chemistry, catalysis, materials science, and the biological fields. Opportunities will be provided to integrate the learning experience with the organization of information through writing assignments and class discussions.

CHEM 517: Organometallic Chemistry

3 Credits

Organometallic compounds and their use in catalysis and organic synthesis. CHEM 517 Organometallic Chemistry (3) CHEM 517 provides a graduate-level foundation to a broad range of topics in organotransition metal chemistry with a particular emphasis on catalytic applications in polymer chemistry and organic synthesis. The course assumes a B.S. level understanding of inorganic and organic chemistry. Topics to be covered include the following: basic principles of bonding and structure, elementary reaction mechanisms, and catalytic applications including olefin insertion reactions, cycloisomerization reactions, carbenoid chemistry including olefin metathesis, carbonylations, reactivity of metal allyl complexes, cross coupling and related C&C bond formations, oxidations, reductions and alkylations. Upon successful completion of this course, students can expect to: 1) understand basic concepts in bonding and molecular structure of organometallic compounds, 2) be able to connect electronic and molecular structure with chemical reactivity, 3) describe organometallic reactivity in a mechanistically rigorous fashion, 4) be familiar with common catalytic paradigms that rely on organometallic catalysts, 5) be equipped to critically evaluate the modern primary literature in this field.

CHEM 518: Symmetry and Spectroscopy in Inorganic Chemistry

3 Credits/Maximum of 99

Group theoretical methods and spectroscopies of importance in modern inorganic chemistry. CHEM 518 Symmetry and Spectroscopy in Inorganic Chemistry (3 per semester) CHEM 518 provides a graduate-level foundation in molecular group theory and its use in understanding the molecular orbital structure of organic and inorganic molecules. EPR, NMR, rotational, vibrational, and electronic spectra of molecules are considered with an eye towards using symmetry to simplify analysis. Other spectroscopies of interest to the modern inorganic chemist, such as XPS, PES, and x-ray crystallography are also discussed.

Prerequisite: CHEM 452

CHEM 519: Materials Chemistry

3 Credits

The goal of this course is to provide students with an understanding of the ways in which fundamental chemical principles are utilized in the field of materials science. The approach is to illustrate the crucial importance of synthesis and structure-property chemical relationships in the development of new materials and their utilization in devices. Topics include glasses, oxides and non-ceramics, polymers, metals, semiconductors, superconductors, hybrid materials, and nanomaterials together with the broad range of energy-related, electronic, biomedical, and optical devices on which modern civilization depends. Most of the different types of materials will be discussed, together with approaches to overcome their limitations.

CHEM 520: Polymer Science and Engineering

3 Credits

This course provides fundamental understanding of basic principles in polymer science and connects these to current research topics at Penn State as well as novel findings in soft material science at other institutions. Interdisciplinary in content, the curriculum spans from polymer synthesis (chemistry), to physical properties (physics), to characterization, to engineering (chemical engineering), to application of polymer materials (materials science). Two areas of focus will lie on (i) the environmental impact of commodity plastics and (ii) conductive polymers and their every-day use in display technology and energy harvesting. While polymers are versatile and broadly applicable, there lie significant dangers in their use for us as a society. For example, while the drive for flexible displays and solar cells is increasing, there is no clear pathway for efficient recycling of the resulting electronic polymeric materials. To this end, this course will engage students in discussions about industrial processing of polymers and the importance to find new pathways for their recycling.

Cross-listed with: CHE 520, MATSE 520

CHEM 524: Electroanalytical Chemistry

3 Credits

Electrochemical principles, techniques, and analytical applications. CHEM 524 Electroanalytical Chemistry (3) CHEM 524 covers the fundamental background and applications of electroanalytical methods. Potentiometric methods are discussed in the context of the basic principles of electrochemical equilibrium. Amperometric methods - chronoamperometry, chronocoulometry, stripping voltammetry, cyclic voltammetry, pulse and hydrodynamic techniques - are also discussed in the context of mathematical models for mass transport and electrode kinetics. Applications including spectroelectrochemistry, photoelectrochemistry, ultramicroelectrodes, corrosion, and scanning electrochemical microscopy are covered. The course involves solving differential equations relevant to electrochemical problems by analytical methods as well as by means of digital simulations, so prior knowledge of a programming language is recommended.

CHEM 525: Analytical Separations

3 Credits

Fundamentals and applications of modern chromatographic separations.

Cross-listed with: BMMB 525

CHEM 526: Spectroscopic Analysis

3 Credits

An overview of modern instrumental techniques including FTIR, optical spectroscopy, mass spectrometry, and electron spectroscopies.

CHEM 535: Physical Organic Chemistry

3 Credits

Reactive intermediates, reaction kinetics and thermodynamics, solvent effects, conformational analysis, reaction mechanisms, noncovalent interactions in synthesis, and stereochemistry.

Prerequisite: CHEM 212

CHEM 536: Medicinal Chemistry and Chemical Biology

3 Credits

The goal of this course is to provide a foundation in development and application of chemical technologies to the understanding and manipulation of biological systems. Chemical biology is a relatively new field that spans the traditional fields of chemistry and biology by applying chemical technologies to the understanding and manipulation of biological systems. As such, this course should be accessible and provide benefit to students working in both chemical and biological areas. Lectures include higher-level biological chemistry (assuming prior knowledge of biological chemistry at an undergraduate level, such as CHEM 476 or BMB 401) and synthetic chemistry and biology principles along with current literature in the field of chemical biology.

Prerequisite: CHEM 476 or B M B401

Cross-listed with: BMMB 536

CHEM 537: Organic Synthesis

3 Credits

Organic synthesis including both classical and modern synthetic methodology as well as applications to construction of complex molecules.

Prerequisite: CHEM 535

CHEM 538: Spectroscopic Methods in Bioinorganic Chemistry

3 Credits

Foundations in spectroscopic methods employed for the determination of the geometric and electronic structure of transition metal clusters in nature.

Cross-listed with: BMMB 538

CHEM 539: Biochemical Reaction Mechanisms

3 Credits

Mechanisms of the most important biochemical reactions, with emphasis on enzyme catalysis.

Prerequisite: CHEM 476 or B M B401

Cross-listed with: BMMB 539

CHEM 540: Biophysical Chemistry

3 Credits

This three-credit course will cover the key theories and experimental methods of contemporary biophysics and biophysical chemistry. The course discusses the structures and dynamics of biomolecules (such as proteins, DNAs, and RNAs), the statistical mechanical models to describe the behaviors of biopolymers and the biophysical methods to analyze the structures of biopolymers in solution, the biophysical theories for protein folding/unfolding and the experimental methods to measure the kinetics of protein folding/unfolding and the protein structural dynamics, the principles of biomolecule structure determination by X-ray crystallography and cryogenic electron microscopy, and fluorescence microscopes, as well as the theories to describe ligand binding to biological macromolecules (such as receptors, protein complexes, aptamers, etc.) and the experimental methods to measure ligand binding. For all the topics covered by this course, emphasis will be laid on both theoretical models and experimental methods will be discussed. Classic and modern biophysical and biochemical techniques ranging from spectroscopy and FRET to optical microscopy, including super-resolution and micromanipulation techniques, will be covered. Applications of these biophysical techniques will also be discussed.

Prerequisite: CHEM 450

Cross-listed with: BME 540

CHEM 543: Polymer Chemistry

3 Credits

This graduate course discusses the new advances in polymer chemistry that leads to new polymeric materials with interesting structures and properties. CHEM (MATSE) 543CHEM (MATSE) 543 Polymer Chemistry (3) This course provides advance level of polymer chemistry and materials taught in MATSE 441 - Polymeric Materials. Students are able to know the versatility that is inherent in polymer chemistry and the new research results and activities, especially controlling polymerization, polymer structures, designing polymers with desirable properties, etc. Students shall also understand the major economic and environmental concerns and solutions in producing commercial-scale polymers. This polymer chemistry course provides important links between chemistry and polymeric materials. The course will focus on recent advances in polymer chemistry that affords new polymer materials with controlled polymer structures, compositions, and properties, as well as economic and "green" processes. This course is designed for graduate students having basic knowledge in organic, inorganic, and organometallic principles. For Chemistry major, this course offers students with the knowledge to apply chemical principles and methods to design and prepare the desirable polymers (no prerequisite for Chemistry graduate students). For Material Science and other majors, this course provides advance level of polymer chemistry and materials taught in MATSE 441 (a prerequisite course). In addition, each student will be required to review (presentation and term-paper) a contemporary subject relative to polymer chemistry, which will help student self-education, and presentation and writing skills. Students will be evaluated by quizzes and examinations, a term-paper and presentation, and class participation.

Prerequisite: MATSE441 or approval of program

Cross-listed with: MATSE 543

CHEM 545: Statistical Thermodynamics

3 Credits

Basic principles of statistical mechanics with application to the calculation of thermodynamic properties of gases and condensed phases.

Prerequisite: CHEM 450 , CHEM 452

CHEM 565: Quantum Chemistry I

3 Credits

A foundation in the principles of quantum mechanics and their applications to chemistry.

Prerequisite: CHEM 452

CHEM 566: Quantum Chemistry II

3 Credits

Additional techniques in quantum mechanics, with applications to problems in molecular structure and light-matter interactions.

Prerequisite: CHEM 565

CHEM 567: Molecular Spectroscopy

3 Credits

Principles and applications of classical and modern spectroscopic methods.

Prerequisite: CHEM 565

CHEM 572: Nucleic Acids Chemistry

3 Credits

Biophysical and biochemical approaches for studying structure-function relationships in nucleic acids. BMMB (CHEM) 572 Nucleic Acids Chemistry (3) The goal of this course is to provide a foundation in biophysical approaches for studying the quantitative and structure-function relationships in nucleic acids systems, including DNA, RNA, and their interactions with proteins, salt, and water. Lectures include basic physical chemistry and statistical mechanics principles along with current literature in the biochemical sciences. At the end of the course, you should be able to meaningfully dissect molecular biological papers at the level of the physical chemistry of these processes. Current topics are introduced through reading and presenting papers from the literature.

Prerequisite: CHEM 212 , CHEM 450

Cross-listed with: BMMB 572

CHEM 573: NMR Spectroscopy for Synthetic and Biological Chemistry

3 Credits

Nuclear magnetic resonance approaches for characterizing the structure and dynamics of synthetic compounds, natural products, and biological macromolecules.

Prerequisite: CHEM 452

Cross-listed with: BMMB 573

CHEM 574: Metals in Biology: Structure and Mechanism

3 Credits

The goal of this course is to acquaint students with the many important roles that metal ions play in biological systems (bioinorganic chemistry). We will explore how structural biology, enzymology, spectroscopy, cell biology, and chemical biology methods have been used to understand how metal ions are used in biological molecules. These approaches have enabled discovery of the chemistry of these systems, and an understanding of how that chemistry fits into the broader biological context. We will apply bioinorganic chemistry in solving important challenges in energy, health, and the environment. Course activities include application of basic inorganic chemistry and biochemical principles, discussion of current literature in the biochemical sciences, implementation of biomolecular structure visualization software, and problem solving. At the end of the course, students will be able to critically engage with the bioinorganic literature and propose experimental approaches to unresolved questions in the field.

Prerequisite: CHEM 476 or BMB 401 Recommended Preparations: CHEM 412

Cross-listed with: BMMB 574

CHEM 589: Studies in Chemistry

1-9 Credits/Maximum of 9

Theoretical research, experimental research, or a critical survey of the literature in an area of chemistry.

CHEM 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

CHEM 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

CHEM 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

CHEM 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Teaching of chemistry undergraduate laboratory and recitation classes with senior faculty instruction supervision.

CHEM 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

CHEM 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

CHEM 810: Liquid Chromatography I

1 Credits

The course specifically caters to the needs of the analytical chemical industry and individuals newly hired into entry-level sample management/preparation and quality assurance/quality control positions within companies using liquid chromatographic techniques. The course material is designed to increase student understanding of both the liquid chromatography instrument used in the laboratory and the principles underlying the measurements.

CHEM 811: Liquid Chromatography II

1 Credits

The course specifically caters to the needs of the analytical chemical industry and individuals hired into, or transitioning into, technician level positions within companies using liquid chromatographic techniques. The course material is designed to increase student understanding of both the liquid chromatography instrument used in the laboratory and the principles underlying the measurements.

Prerequisite: CHEM 810**CHEM 812: Liquid Chromatography III**

1 Credits

The course specifically caters to the needs of the analytical chemical industry and individuals hired into, or transitioning into, development-level, or senior-level, chemist positions within companies using liquid chromatographic techniques. The course material is designed to increase student understanding of both the liquid chromatography instrument used in the laboratory and the principles underlying the measurements.

Prerequisite: CHEM 811**Chinese (CHNS)****CHNS 596: Individual Studies**

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

Civil Engineering (CE)**CE 511: Engineering Soil Characteristics**

3 Credits

Applications of physico-chemical principles in soil engineering; soil composition; factors influencing engineering soil properties.

Prerequisite: C E 335**CE 512: Soil Mechanics II**

2-5 Credits/Maximum of 5

Evaluation of strength parameters and compressibility of soils; elastic analysis of stress and strain; techniques of forecasting foundation settlement; slope stability analysis.

CE 513: Advanced Foundation Engineering

3 Credits

Practical applications of soil mechanics principles to geotechnical engineering problems; dewatering techniques; design of deep foundations and retaining structures.

Prerequisite: C E 335**CE 521: Transportation Networks and Systems Analysis**

3 Credits

Techniques of transportation network, user, stochastic user, and variable demand equilibrium; transportation activity system; computer simulation techniques and forecasting methods.

Prerequisite: 3 credits of computer science**CE 522: Traffic Flow Theory and Simulation**

3 Credits

This course will cover advanced topics related to traffic operations and traffic flow theory. Students will be exposed to a variety of theories, methodologies, and principles that are used to assess traffic operations on surface transportation systems, as well as their applications. The course will be divided into two major subject areas: 1) operations on uninterrupted facilities, such as freeways; and, 2) operations on interrupted facilities, such as urban streets and large urban networks. Topics in the former area include kinematic wave theory, cell and link transmission models, variational theory, moving-bottlenecks, bottleneck identification and incident management. Topics in the latter include signal coordination, macroscopic fundamental diagrams, multimodal conflicts and their impacts. The course also includes an overview of traffic microsimulation software and its applications to both areas.

Concurrents: CE 423**CE 523: Analysis of Transportation Demand**

3 Credits

Theories of travel behavior, least squares and maximum likelihood, estimation methods, continuous dependent variable models, utility maximization, discrete econometric techniques.

Prerequisite: 3 credits of probability and statistics**CE 525: Transportation Operations**

3 Credits

Tools for analyzing transportation operations, including: properties of traffic streams, queuing, traffic dynamics, networks, probability and estimation of traffic properties. C E 525 Transportation Operations (3) This course presents the concepts of traffic and transportation operations necessary for students pursuing an advanced degree in transportation engineering. While the course focuses on surface traffic and related systems, the tools and methods discussed can be used in other sub-disciplines (e.g., public transportation, aviation, and bicycle/pedestrian movement) to analyze operations. Logic and methods are emphasized as opposed to recipes that are specific to certain modes.

Prerequisite: C E 423

CE 526: Highway and Street Design

3 Credits

Technical analysis of the design elements of roadways, alignment, cross-section features, and intersection and interchange design considerations.

Prerequisite: C E 421

CE 527: Roadside Design and Management

3 Credits

Roadside safety and design, safety management, pavement management, lighting, signs, signals, and markings, clear zone, guiderail, impact attenuators.

Prerequisite: C E 421W

CE 528: Transportation Safety Analysis

3 Credits

Issues and methods in transportation safety analysis; factors contributing to crashes; crash causation; modeling accident occurrence; identifying sites for treatment. C E 528C E 528 Transportation Safety Analysis (3) This course introduces students to issues and methods in transportation safety analysis; factors contributing to crashes; methods of analysis for determining crash causation; modeling accident occurrence; identifying crash sites for treatment. Students will be evaluated using periodic homework assignments, a mid-term exam, and a class project. Students are expected to learn fundamental aspects of highway accident occurrence and modeling. They will be introduced to modeling techniques and methods used to assess causality in crashes. The course is offered annually in the fall semester.

Prerequisite: STAT 401

CE 529: Infrastructure Systems Analysis and Decision Making

3 Credits

This course focuses on the physical infrastructure systems that provide essential public services, including transportation, energy, water, communications, etc. These complex, large-scale, expensive systems must be planned for and managed. This course emphasizes different tools (including basic economic theory, mathematical modeling, and optimization techniques) that can be used to study these complex systems, drawing examples from transportation. This includes evaluation of infrastructure investments; better informing the data collection and inspection process; modeling deterioration of infrastructure components such as pavement; and maintenance and repair decision-making at both the single facility and system level.

CE 531: Legal Aspects of Engineering and Construction

3 Credits

Basic legal doctrines, contractual relationships between parties, analysis of construction contract clauses, contract performance, and professional practice problems.

Prerequisite: C E 431W

Cross-listed with: AE 531

CE 536: Topics in Biogeochemistry

2 Credits/Maximum of 999

This seminar addresses chemical interactions between the biosphere and the physical environment over Earth's history and as impacted by humans. This course will provide a broad survey of biogeochemical principles, and offer a community-building experience for students with biogeochemical interests from diverse departments. Students will complete the course with a synthetic knowledge of the key topics in the field of biogeochemistry. Each week we will focus on a topic within the broad field of biogeochemistry such as: origins of the elements, reactions in the atmosphere, soil development, the distribution of redox reactions and microbial metabolic pathways, and the global cycles of carbon, water, nitrogen, phosphorus, sulfur, mercury, and perhaps other elements. For each topic, we will focus on the questions: What is known or can be observed? How is this information used to understand biogeochemical phenomena and process? How are these processes scaled over time and space? What are emerging and important questions in the subspecialties of biogeochemistry?

Cross-listed with: GEOSC 536, SOILS 536

CE 538: Earthquake Resistant Design of Buildings

3 Credits

Introductory engineering seismology, basic principles of structural dynamics, application of earthquake design provisions of model building codes to design of buildings. A E (C E) 538 Earthquake Resistant Design of Buildings (3) The main objective of this course is to familiarize students with basic principles of design of buildings to resist earthquake effects. Since building design is governed by the Building Code, currently, International Building Code that adopts American Society of Civil Engineers (ASCE) document ASCE-7 for load determination, the seismic provisions of ASCE-7 will be used as the basis for design. The course starts by introducing earthquake phenomenon and engineering seismology concepts. The basic principles of structural dynamics are then covered for single degree of freedom systems starting from free vibration to random loading so that students learn how a ground acceleration time-history subjected to the base of a building can be converted to a time varying effective seismic load on the mass. After introduction of response spectrum, introductory material on multi-degree of freedom systems is introduced so that students can determine natural frequencies and mode shapes for multi-story buildings and perform modal superposition analysis to determine displacement and force responses. Next, the principles of earthquake resisting design related to energy dissipation, ductility, over-strength, and redundancy followed by seismic provision of the building code are discussed. The main design principles related to the two main materials for building construction consisting of reinforced concrete and structural steel are next discussed. The focus will be to illustrate how lateral load resisting systems such as shear walls, moment resisting frames, or braced frames made with such materials as appropriate are designed to resist earthquake effects based on respective material code provisions, that is, American Concrete Institute (ACI) for concrete and American Institute of Steel Construction (AISC) for steel. The last part of the course will introduce seismic retrofit, base isolation systems and the concept of performance based design.

Prerequisite: A E 401 , A E 402 , A E 430

Cross-listed with: AE 538

CE 539: Approximate Methods of Structural Analysis

3 Credits

Structural analysis through the application of initial-value methods, Newmark's method, Fourier series, finite difference techniques, and work and energy procedures.

Prerequisite: C E 340

CE 540: Statically Indeterminate Structures

3 Credits

Analysis of statically indeterminate straight/curved beams, grids, 2D/3D frames, arches, cables, and shells using classical and modern techniques. C E 540 C E 540 Statically Indeterminate Structures (3) This course introduces students to various methods for analyzing statically indeterminate structural systems, including: straight and curved beams, grids, 2D and 3D frames, arches, cables, and shells. Both classical hand calculation approaches and more modern computer based approaches that utilize force and displacement based methods are discussed. Additional analysis topics, such as plastic analysis and the examination of beams on elastic foundations are presented. The procedures are introduced to the students so that their ability to analyze statically indeterminate structural systems is enhanced. In addition, practical applications for the methods that are discussed are presented.

CE 541: Structural Analysis

3 Credits

Theory of various finite elements as applied to civil engineering structures. Term paper required.

Prerequisite: C E 447

CE 542: Building Enclosure Science and Design

3 Credits

The building enclosure: nature, importance, loadings; building science: control of heat, moisture, air, hygrothermal analysis; design: walls, windows, roofs, joints. A E 542 A E (C E) 542 Building Enclosure Science and Design (3) The building enclosure, or envelope, is the environmental separator in any building and is, like the superstructure and the service systems, one of the major physical components of the building. The primary objective of this course is to develop an understanding of the nature, importance, functions, and performance of the building envelope in general. The necessary building science—concerning primarily heat, moisture, and air—is covered, and hygrothermal analysis procedures are developed. A generalized categorization system for enclosure elements, i.e., walls (both above- and below-grade), roofs, and other enclosure sub-assemblies is proposed. General design strategies are developed. The design of specific wall systems (both above- and below-grade), roof systems, base floors, windows, and their joints is then addressed in some detail. The integration of structures (composite action, restraints, etc.), service systems (especially energy consumption), and finish (exterior and interior) is considered in some detail. Evaluation is based on an equal combination of assignments (6) and examinations (2). This course complements courses in architecture, civil engineering, architectural engineering, and mechanical engineering.

Cross-listed with: AE 542

CE 543: Prestressed Concrete Behavior and Design

3 Credits

Design and behavior of prestressed concrete structures: materials and systems losses, flexure, shear, bond, deflections, partial prestressing, continuous beams.

Prerequisite: C E 341 , A E 402 , or approved equivalent

CE 544: Design of Reinforced Concrete Structures

3 Credits

Advanced topics in design of reinforced concrete structures. Torsion and shear; beam moment-curvature; two-way slab systems; slender columns; strut- and-tie methodology. C E 544 C E 544 Design of Reinforced Concrete Structures (3) This course explores advanced topics in the design of reinforced concrete structures in conformance with standardized building codes. Topics covered include load combinations, principles of structural modeling, torsion and shear in reinforced concrete members, two-way slab systems, moment-curvature of beams, slender columns, and strut-and-tie models. Students enrolled in this course should have prior knowledge of the design of reinforced concrete beams, one-way slabs, and short columns. Due to the course content, students must be familiar with the American Concrete Institute (ACI) Building Code Requirements for Reinforced Concrete. This course will generally be offered each fall, with an anticipated enrollment of 10. Grades will be based on two examinations, assignments, and a comprehensive final examination.

CE 545: Metal Structure Behavior and Design

3 Credits

Design philosophies and basis; seismic loading; fatigue; bending, column, plate, and beam-column stability; tapered members; torsion; connections; bracing; frame stability. C E 545 C E 545 Metal Structure Behavior and Design (3) This course presents advanced topics in elastic and inelastic structural metal member behavior and the theoretical basis of modern design codes and procedures. Philosophies of design, fatigue, bending stability and tapered members, torsion, stability of plates, stability of columns, stability of beam-columns and bi-axial bending, connections, and frame stability are covered in depth in addition to other topics relating to advanced behavior and design of metal structures. Students interested in this course must be familiar with the American Institute of Steel Construction (AISC) Manual of Steel Construction. This course will generally be offered each fall, with an anticipated enrollment of 12. Grades will be based on homework assignments, a semester project, two examinations, and a comprehensive final examination.

CE 548: Structural Design for Dynamic Loads

3 Credits

Dynamic behavior of structural systems of one and more degrees of freedom; earthquake, blast-resistant analysis, and design of structures.

Prerequisite: E MCH212 , C E 340

CE 549: Bridge Engineering I

3 Credits

Engineering of modern steel and concrete bridge structures; loading; analysis; design.

Prerequisite: C E 448W

CE 550: Engineering Construction Management

3 Credits

Management fundamentals for construction contracting; organization, project planning, scheduling and control, bonding and insurance, labor legislation and regulation, cost and control.

Prerequisite: C E 431

CE 551: Random Processes in Hydrologic Systems

3 Credits

Hydrologic systems analysis, simulation; design using probability, time series and dynamical systems; formulating models, parameter estimation, environmental impact, resource assessment.

Prerequisite: C E 361 ; introductory probability and statistics

CE 555: Groundwater Hydrology: Analysis and Modeling

3 Credits

Introduction to groundwater resource analysis, model formulation, simulation, and design of water resource systems using symbolic and numerical methods.

Prerequisite: MATH 251

CE 556: Environmental Electrochemistry

3 Credits

This goal of this course is to prepare students to perform and interpret research in the field of environmental electrochemistry. Students will learn the fundamental mechanisms of electrochemistry and will apply this knowledge to (1) design theoretical experiments to address research questions relevant to environmental engineering and science and (2) analyze and re-interpret results from recently published peer-reviewed studies in this field. Within the field of environmental engineering and science, electrochemical techniques are commonly used to characterize the reactivities and thermodynamic properties of environmental samples, such as soils, minerals, and natural waters. Electrochemical techniques are also frequently used to solve environmental problems, with applications including the treatment and remediation of polluted water and the generation of renewable electricity from waste sources. This course is designed to enable students to critically read environmental electrochemical literature and to design and develop their own electrochemical experimental systems. To achieve this goal, the course consists of five sections that are roughly equal in length. Section 1 covers the underlying chemistry and thermodynamics relevant to electrode potentials and redox chemistry. Section 2 covers galvanic and electrolytic reactions by covering examples of batteries and fuel cells relevant to environmental engineers. Section 3 addresses the role that kinetics and transport play in electrochemical systems and the mathematical expressions used to cover them. Section 4 covers electrochemical techniques used to study environmental systems and

solve environmental engineering problems, such as pollution remediation and renewable energy production. Section 5 covers electrochemical impedance spectroscopy, a complex electrochemical technique used to determine how an electrochemical system can be best approximated as a circuit. As a whole, these sections develop students with the educational foundation necessary to further study specific topics relevant to their research or interests.

CE 561: Surface Hydrology

3 Credits

Quantification of the processes that govern the movement and storage of water near the land-surface including precipitation, evapotranspiration, and runoff. C E 561 C E 561 Surface Hydrology (3) Water is an important factor in numerous engineering and scientific problems. It can be both a hazard and a resource. Knowledge of the movements and storage of water in the terrestrial, oceanic, and atmospheric environments is fundamental in many such applications. This course provides a graduate level introduction to surface hydrology, which focuses on the quantification of water pathways near the land-surface. It presents basic properties of the terrestrial, oceanic, and atmospheric environments and develops water and energy budget equations for different settings and scales. The course also provides detailed quantitative descriptions of the main processes responsible for the movement of water in the environment including precipitation, evapotranspiration, snowmelt, infiltration, surface runoff, groundwater recharge, subsurface runoff, and streamflow.

CE 563: Systems Optimization Using Evolutionary Algorithms

3 Credits

Comprehensive introduction to genetic and evolutionary computation: genetic algorithms, evolutionary strategies, multi-objective optimization, parallelization approaches, and fitness approximation. C E 563 C E 563 Systems Optimization Using Evolutionary Algorithms (3) A comprehensive introduction to the field of genetic and evolutionary computation. The course emphasizes state-of-the-art methods for designing and implementing evolutionary algorithms for computationally intensive engineering and science problems. Course concepts are demonstrated using case studies drawn from the disciplines of the students enrolled. The course is offered every spring semester.

CE 564: Sediment Transport in Alluvial Streams

3 Credits

River flow, river channel formation, the physical characteristics of rivers, responses of rivers to natural and human-made changes. C E 564 C E 564 Sediment Transport in Alluvial Streams (3) A comprehensive presentation of river processes and engineering must be built upon the foundations of fluvial geomorphology, hydraulics of river flow, and sediment transport. The course is organized into the following five principal parts: Part I. Fluvial Geomorphology Part II. Foundations of Fluvial Process Part III. Regime Rivers and Processes Part IV. Mathematical Modeling of River Channel Changes Part V. River Engineering

Prerequisite: C E 462

CE 566: Uncertainty and Reliability in Civil Engineering

3 Credits

Introduction to probabilistic modeling, simulation, uncertainty analysis, and reliability estimates applied to civil engineering. C E 566C E 566
Uncertainty and Reliability in Civil Engineering (3) The objective of this course is to develop understanding of the uncertainty in Civil Engineering analyses, design, and construction and to introduce reliability-based methods of analysis. The course covers review of probability and statistics, uncertainty analysis, probabilistic models of load and resistance, and the application of reliability analysis to problems in Civil Engineering.

CE 567: River Engineering

3 Credits

Introduction to river mechanics and fluvial geomorphology applied to problems of sediment transport and channel morphology. C E 567C E 567
River Engineering (3) River Engineering will introduce students to the concepts of flow and sediment transport in canals and alluvial rivers. This course covers: river morphology and hydraulic geometry; hydraulics of flow in river channels; measurement of velocity; rating curves; properties of sediment; scour-related problems; stream stability and classification; sediment movement in rivers; channel design; software for erodible channels; stream bank, bridge pier, and bridge abutment protection; environmental considerations; and stream restoration. During the semester, the students will visit local streams for the purpose of making various observations and measurements. Faculty: Peggy A. Johnson

CE 570: Environmental Aquatic Chemistry

3 Credits

Speciation, reactivity, and distribution of contaminants in water, with emphasis in inorganic chemicals.

Prerequisite: C E 475

CE 571: Physical-Chemical Treatment Processes

3 Credits

The theory of physical-chemical processes used in the treatment of potable water and municipal and industrial wastewaters.

Prerequisite: C E 472 , C E 475

CE 572: Biological Treatment Processes

3 Credits

The theory and application of biological processes to treat organic wastes, including wastewater, solid residuals, and toxic priority pollutants.

Prerequisite: or concurrent: C E 475

CE 573: Environmental Organic Chemistry

3 Credits

Theory, measurement, and estimation of the characteristics and environmental transformations of hazardous materials.

Prerequisite: C E 475

CE 574: Reactive Transport Processes in Porous Media

3 Credits

Recommended Preparations: It is recommended that the students have taken courses on principles of water chemistry, biogeochemistry, or water-rock interactions. This course teaches principles and modeling of flow, transport, and reaction processes in the natural and built environment. The course targets students from a range of disciplines where water-mineral-microbe interactions play a key role. This includes, but not limited to, environmental engineering, water resources, geosciences, petroleum and natural gas engineering, agricultural engineering, civil engineering, chemical engineering, and applied mathematics. The course teaches fundamental concepts, mathematical formulation, and quantitative representation, and applications of multi-component reactive transport processes. The learning outcomes are to 1) understand fundamental concepts of biogeochemical reactions, flow, and solute transport; 2) understand reactive transport equations and concepts of numerical solution; 3) develop computational skills using a reactive transport modeling code. The students will grasp reactive transport concepts, as well as skills to set up reactive transport models, interpret data, and predict subsurface physical flow and geochemical and microbiological process coupling.

CE 575: Industrial Waste Management

3 Credits

Surveys and analysis, pollution prevention, regulatory requirements, treatment and disposal of liquid, gaseous and solid residues.

Prerequisite: C E 472

CE 576: Environmental Transport Processes

3 Credits

Fundamentals of chemical transport in engineered environments, such as biofilm reactors, and natural systems including aquifers and rivers. C E 576C E 576
Environmental Transport Processes (3) Environmental Transport Processes covers the fundamental of mass transport of chemicals between air, water, soil, and biota. Material is divided into three subject areas: mass transfer theory, transport processes related to engineered reactors, and transport in the natural environment. The focus of the course is on chemical calculations particular to dilute systems, with emphasis on quantifying chemical transport rates and distributions in natural and engineered environments. Special topics of interest to environmental engineers include biofilm models, bioreactors, chemical partitioning in thin fluid film bioreactors, and fate of anthropogenic chemicals from spills and discharges into the environment (i.e., rivers, lakes, and groundwaters). Faculty: Bruce E. Logan

Prerequisite: C E 475

Cross-listed with: CHE 576

CE 577: Treatment Plant Design

1-6 Credits/Maximum of 6

Design of works for the treatment of water and wastewater for municipalities and industries.

Prerequisite: C E 472 ; 3 credits in hydraulics

CE 578: Groundwater Remediation

3 Credits

Application of fundamental physical/chemical/biological processes in natural and engineered systems for remediation of contaminated soil and groundwater.

Prerequisite: C E 475

CE 579: Environmental Pollution Microbiology

3 Credits

Fundamentals of microorganisms in water and wastewater treatment; indicators of pollution; activities of microorganisms in polluted waters, including biogeochemical cycles.

CE 580: Hydrodynamic Mixing Processes

3 Credits

Physical mixing processes in rivers, estuaries, lakes, and oceans. Analytic methods and computational modeling. C E 580C E 580 Surface Water Quality Models (3) Hydrodynamic Mixing Processes is concerned with the transport and dispersal of tracers in natural water and air environments. It straddles the boundary between traditional civil engineering fluid mechanics (concerned with water quantity) and environmental engineering (concerned with water quality). Emphasis is placed on understanding the physical hydrodynamic processes responsible for tracer dispersal and application to practical problems through use of freely-available numerical models.

CE 581: Civil Infrastructure Asset Management

3 Credits

This course provides students with comprehensive knowledge of civil infrastructure asset management at the systems level - from state-of-the-practice to research frontiers. Particular emphasis is placed on transportation and networked infrastructure across multiple modes, including pavements, bridges, geotechnical structures, roadside appurtenance and signs, waterways, airfields, railways, and pipelines. Applications to other civil infrastructure assets (e.g., dams) are also considered. The life-cycle management of public infrastructure has become increasingly critical in the 21st century. For most countries, the infrastructure to support various modes of transportation - railways, roadways, bikeways, pedestrian facilities, pipelines, waterways, and airfields - is the most valuable publicly owned infrastructure. Transportation infrastructure asset management, or civil infrastructure asset management, is the systematic process of making decisions regarding the construction, maintenance, repair, and replacement of infrastructure components to maximize the functional performance of the system within economic constraints of both agencies and users. In this course, the key components of an effective infrastructure asset management system are examined in the context of contemporary and future challenges—including sustainability, resilience, climate change, autonomous vehicles and smart infrastructure, and equity.

CE 582: Pavement Design and Analysis

3 Credits

Viscoelastic analysis; non-linear analysis; fatigue and permanent deformation; back-calculation of layer moduli; mechanistic-empirical design methods.

CE 583: Bituminous Materials and Mixtures

3 Credits

Composition, physical behavior, production, and performance of bituminous materials and mixtures.

CE 584: Concrete Materials and Properties

3 Credits

Study of concrete properties and associated variables, prediction models, testing, preventative measures, pozzolans, admixtures.

Prerequisite: A E 221 or C E 336

CE 585: Advanced Characterization of Cementitious Materials

3 Credits

This graduate level course will familiarize students with advanced experimental and characterization techniques that are commonly used for studying cement and concrete materials. In addition, students will learn and practice on several advanced topics related to cement chemistry. The methods that are commonly covered include electron microscopy, X-ray diffraction, thermogravimetric analysis, mercury porosimetry, gas adsorption and BET, particle characterization, isothermal calorimetry, and thermodynamic modeling. Students will learn the principles and theories behind each technique as well as the correct methods for sample preparation and data analysis that are unique to cementitious materials. Students will learn and practice these techniques through reading assignments, interactive classroom discussions, laboratory demonstrations, and a term project.

CE 587: Computational Ecohydrology

3 Credits

Ecohydrology is an integrative science that studies mutual interactions between hydrological, biogeochemical, and ecological processes. The lectures of the course will discuss the fundamental processes controlling the flow of water in the biosphere (in land, atmosphere, soil, and plants) and the interactions with ecological processes, implications of ecohydrological feedbacks covering broad range of issues including global environmental change, land use change, global desertification/land degradation, urbanization, soil erosion, and the food-energy-water nexus. The computational lab will provide hands-on experience on ecohydrological analysis with geographic information system software and ecohydrologic model. The course will also introduce students to parallel computing and optimization methods.

Recommended Preparation: Previous coursework in hydrology is expected

Cross-listed with: ABE 587

CE 589: Critical Zone Science Seminar

1-3 Credits/Maximum of 3

This course will explore the foundations, discoveries, and applications linked to the Critical Zone concept through primary literature, class discussions, and original student projects. We will start by spending one week each on the four foundational science domains that are woven together to make Critical Zone science: hydrology, geoscience, soil science, and ecology. Then we will spend several weeks highlighting key discoveries that arise from the interdisciplinary Critical Zone perspective. The end of the class explores whether the Critical Zone science perspective might have useful applications for land and water management. Throughout the class, students take a co-leadership role with the instructors in terms of selecting readings, lecturing, and designing active learning allied with key concepts.

Cross-listed with: GEOSC 589, SOILS 589

CE 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

CE 591: Environmental Engineering Seminar

1 Credits

Seminar topics selected by faculty and students based on research interests on topics related to environmental engineering and science. C E 591 C E 591 Environmental Engineering Seminar (1) This is a seminar course offered primarily for graduate students in Environmental Engineering, although other graduate students with interests in environmental research take this course. Graduate students may receive only 1 credit of this seminar towards a degree in Environmental Engineering, however, they are encouraged to register and attend every semester during their graduate career. This course is offered for 1 credit for both fall and spring semesters. Students making presentations receive letter grades, while others receive a satisfactory/unsatisfactory grade. Seminar topics are selected by faculty and students based on research interests on topics related to environmental engineering and science. Most of the talks will be by environmental engineering graduate students. However, during the semester there will typically be three outside speakers that will be invited to give talks. Students in this class are expected to meet with these outside speakers in the laboratory to discuss their own research projects. Students in this class give short presentations on their research topics. Each presentation should be about 20 minutes in length, allowing for 10 minutes of questions concerning the technical content of the presentation. The rest of the class is used for general discussion. Students are encouraged to give a seminar even though they have not completed all of their research (i.e. prior to their defense). Feedback from faculty and other students in this informal setting can be used to help improve research ideas and stimulate new ideas and research directions during the course of their research work.

CE 592: Environmental Engineering & Science Topics

1 Credits

Current topics in environmental engineering and science. C E 592 C E 592 Environmental Engineering & Science Topics (1) This is a literature review course for graduate students interested in topics related to

environmental engineering. The subject of this seminar changes each semester. Examples of topics include: membrane bioreactors; biological hydrogen production; metal reduction by soil bacteria; anaerobic respiratory pathways used by bacteria for pollutant degradation. This class is highly participation-oriented. Each week we review a single paper selected by the instructor or by a student in the class. The first two papers are selected by the instructor. Thereafter, students choose the paper. The paper must be selected one week in advance, and sufficient copies will either be brought to class or a pdf file will be provided by email to all participants one week prior to the class. The student choosing the paper will be expected to lead the discussion by: prompting others to provide a summary of the paper or of key items; suggesting areas that require closer inspection; stimulating a critical evaluation of the paper. No background is needed on this topic other than general environmental engineering courses typical of an M.S. program in Environmental Engineering.

CE 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

CE 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

CE 598: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

CE 599: Foreign Studies

1-2 Credits/Maximum of 4

Courses offered in foreign countries by individual or group instruction.

CE 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

CE 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

CE 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Supervised experience in college teaching.

CE 603: Foreign Academic Experience

1-9 Credits/Maximum of 18

Foreign study and/or research constituting progress towards the degree at a foreign university.

CE 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

CE 835: Integrated Project Management for Civil Engineers

3 Credits

This course will present the project management process to students pursuing a graduate degree in Civil Engineering. The course will utilize a project/group-based learning process to teach project management's value, methodology, and application to civil and environmental engineering projects in the student's particular emphasis area (Infrastructure, Transportation Systems, or Water and Environment). Students will learn how to initiate, plan, organize, staff, direct, control, and closeout a project. Key topics to be discussed include: the role of the project manager, civil engineering project procurement/proposal development, importance and skills of communications, project team development and leadership, team conflict resolution, design management, scope management, work breakdown structure (WBS), scheduling/time management, budgeting/cost management, risk management, resource management, crisis management, earned value, project evaluation and control, and project closeout and termination.

Classics and Ancient Mediterranean Studies (CAMS)

CAMS 501: Comparative Greek and Latin Grammar

3 Credits

This course establishes the historical, linguistic and cultural foundations of proto-Indo-European, the reconstructed ancestral language which underlies most of the languages of Europe and some of the languages of western Asia and the Indian subcontinent. In the first part of the course, a uniform reconstructed system for the protolanguage is developed, based on the comparative analysis of the major branches of the Indo-European language family. Once the essential character of the protolanguage has been established, the course concentrates on the evolution of the two classical languages, Greek and Latin, as historical outcomes of the proto-Indo-European ancestral system. Special emphasis is laid on the systematic study of the vocabulary, the sound system and the system of word-formation, and on the similarities and differences which are evident in the two classical languages.

Recommended Preparations: Students should have completed basic Greek and Latin courses; a background in historical linguistics is recommended.

CAMS 503: Seminar on Ancient Mediterranean Languages

3-9 Credits/Maximum of 9

This course features advanced study of a particular ancient Mediterranean language or dialect, group of languages or dialects, or a specific language topic, such as philology, paleography, epigraphy,

or linguistics in the Ancient Mediterranean, including Rome, Greece, Egypt, Syria, Anatolia, Mesopotamia, Iran, Arabia, etc. The choice of primary topic in each iteration of the course is made by the instructor. The following are some examples of topics: "Seminar in Old Egyptian Texts" (or Middle Egyptian, or Late Egyptian texts); "Akkadian Dialects"; "Mishnaic Hebrew"; "Regional Greek Epigraphic Texts"; "Bohairic Coptic"; "Old Persian Inscriptions"; "Vulgar Latin"; "Imperial Aramaic," or others. As such, this course is repeatable by students. The aim of the course is to provide students with critical exposure to aspects of ancient Mediterranean language study as well as a solid grounding in scholarly research methods for ancient language study.

CAMS 520: Advanced Sumerian

3 Credits

Advanced study of Sumerian grammar and cuneiform writing through the reading of Sumerian literary texts.

CAMS 521: Advanced Akkadian

3 Credits

Advanced study of Akkadian grammar and the cuneiform script through the reading of texts in various dialects.

CAMS 522: Comparative Semitics

3 Credits

Overview of the Semitic language family and introduction to its comparative linguistic study.

CAMS 530: Ancient Judaism: Special Topics

3 Credits/Maximum of 3

This course offers rotating topics in the study of ancient Judaism. The choice of primary topic in each iteration of the course is made by the instructor. The course features advanced study of Judaism in a range of historical settings, from its beginnings in biblical Israel to the development of Jewish texts, traditions, and communities in the Hellenistic and Roman periods. By adopting a critical approach, this course offers students an opportunity to conduct and examine research on ancient Judaism in a theoretically informed, cross-disciplinary manner. The course brings methods, material, and insights from Jewish studies to bear on ongoing work in many fields, including history, philosophy, political theory, religious studies, and comparative literature. Course topics may be thematic, revolving around specific themes like diaspora, Jewish identity, Jewish experiences of empire, or questions of gender. They may be organized around specific places or periods, for example: the history of Jerusalem, Jews in Hellenistic Egypt, first-century Palestine, Roman-era Alexandria, or late antique Babylon. They may also include the analysis of Jewish literature or textual traditions within their social, political, religious, and cultural contexts. The aim of the course is to provide students with critical exposure to aspects of ancient Judaism as well as a solid grounding in scholarly research methods.

Cross-listed with: JST 530, RLST 530

CAMS 550: Proseminar

3 Credits

The specific aim of this proseminar is to provide a foundation for scholarly work in the disciplines included within Classics and Ancient

Mediterranean Studies. This proseminar will therefore provide the student an overview of the scope and nature of the ancient evidence (literary, documentary, material [archaeological]), the history and historiography of modern study of that evidence and the ways in which research methodologies and techniques have evolved. In addition, the proseminar will introduce students to the nature of contemporary academic presentation and publishing, thereby to assist them in preparing research papers for scholarly dissemination.

CAMS 560: Research Seminar

3 Credits/Maximum of 9

The specific aim of this seminar is to provide a research experience in one of the disciplines included within Classics and Ancient Mediterranean Studies. This seminar will therefore give students an overview of the scope and nature of the ancient evidence (literary, documentary, material [archaeological]), the history and historiography of modern study of that evidence and the ways in which research methodologies and techniques have evolved in a specific discipline of CAMS.

Prerequisite: CAMS 592

CAMS 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

Clinical and Translational Sciences (CTS)

CTS 590: Colloquium

1 Credits/Maximum of 3

Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

CTS 595A: Clinical Science Internship

3-6 Credits/Maximum of 999

Supervised, research-oriented, off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required. Supervised, research-oriented, off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required. Students enrolling in this course must 1) be at least a 2nd year graduate student; 2) have completed the online CITI Program course in Human Subjects Research; and 3) have identified an available mentor in a clinical setting.

Prerequisite: CTS 590

CTS 595B: Translational Science Internship

3-6 Credits/Maximum of 6

Supervised, research-oriented, off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required. Supervised, research-oriented, off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required. Students

enrolling in this course must 1) be at least a 2nd year graduate student; 2) have completed the online CITI Program course in Human Subjects Research; and 3) have identified an available mentor in an industry setting.

Prerequisite: CTS 590

CTS 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

CTS 596B: IBD Nutr Clin Rota

3 Credits

IBD Nutr Clin Rota

CTS 596C: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

CTS 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

Communication Arts and Sciences (CAS)

CAS 500: Historical Public Address

3 Credits/Maximum of 9

Special topics in American public address, 1765-1900; emphasis on rhetoric of revolution, reform, and reaction. CAS 500CAS 500 Historical Public Address (3 per semester/maximum of 9) This is a graduate seminar focusing on special topics in the history of American public address, 1765-1900. It is designed to strengthen students' knowledge of the historical foundations of the American rhetorical tradition. Special attention is paid to key texts, debates, and movements shaping the origins and development of American nationhood. Emphasis is placed on the language of revolution, reform, and reaction. Special topics through which this course is to be taught may include: The Rhetoric of the American Revolution, Rhetoric of Abolitionism and Civil Rights, The Rhetoric of the Women's Suffrage Movement, Great Debates in American History, and Rhetoric and the American Presidency, 1789-1900. Students should consult with the instructor prior to enrolling to ascertain that the course topic is not the same as in prior enrollments.

CAS 503: Rhetorical Criticism

3 Credits/Maximum of 6

An advanced seminar in the history, theory, methods, and practice of rhetorical criticism. CAS 503 CAS 503 Rhetorical Criticism (3 per semester/maximum of 6) An advanced seminar in the history, theory, methods, and practice of rhetorical criticism. Students should consult

with the instructor prior to enrolling to ascertain that the course topic is not the same as in prior enrollments.

Prerequisite: CAS 411

CAS 504: Contemporary Public Address

3-9 Credits/Maximum of 9

Special topics in recent history of American public address, including speeches, debates, persuasive campaigns, and social movements in America 1900-present. CAS 504 CAS 504 Contemporary Public Address (3 per semester/maximum of 9) This course is a graduate seminar focusing on special topics in the history of American public address since 1900. Through intensive study of great speeches and other rhetorical texts, important national debates and controversies, and significant persuasive campaigns and social movements, it cultivates specialized understanding of the distinctively American tradition of public advocacy and deliberation and illuminates how that tradition has evolved in response to political and social developments and new communication technologies. Special topics reflecting the research interests of current faculty who might be expected to teach the course include: "The Rhetoric of the Progressive Era," "The Rhetoric of the New Deal," "The Manifesto in Contemporary Social Movements," "The Rhetoric of Contemporary Political Campaigns," and "The Rhetorical Presidency." Students should consult with the instructor prior to enrolling to ascertain that the course topic is not the same as in prior enrollments.

CAS 505: Historical Development of Rhetorical Theory

3 Credits/Maximum of 9

Study of one or more periods of rhetorical theory from Greek antiquity to 1900.

Prerequisite: CAS 420

CAS 506: Contemporary Rhetorical Theory

3 Credits/Maximum of 6

A study of rhetorical theory from 1930 to the present, focusing on semantic, political, sociological, symbolic, and philosophical perspectives.

Prerequisite: CAS 411 , CAS 505

CAS 507: Issues in Rhetorical Theory

3 Credits/Maximum of 6

Theoretical, analytical, philosophical, and critical problems in human communication, with application of humanistic and social scientific research framework. CAS 507 CAS 507 Issues in Rhetorical Theory (3 per semester/maximum of 6) The seminar is available to members of the faculty who wish to explore specialized problems of a theoretical, analytical, philosophical, or critical nature in human communication research. Its content varies by instructor. Such subject areas of language and meaning, epistemology, ethics and moral philosophy, metaphysics and ontology, the functions of myth, cognition, child development, and brain function may be considered for the contributions they make to our understanding of rhetorical behavior. Special topics reflecting the research interests of current faculty who might be expected to teach the course include: "Rhetoric, Myth, and Cosmology," "Rhetoric and Ethics," "The Rhetorical Construction of Social Identity," and "Rhetoric and Public Deliberation." Students should consult with the instructor prior

to enrolling to ascertain that the course topic is not the same as in prior enrollments.

Prerequisite: CAS 420

CAS 509: Democratic Deliberation

3 Credits

Modern political systems are as likely to move further away from deliberative ideals as toward them, and such movement can undermine a system's democratic legitimacy. This problem has inspired the development of deliberative democratic theory and research, which provides a powerful critique of contemporary politics. The study of deliberation dates back to ancient Greece, which gave us forms of speech that endure to the present day. Current conceptions stress public deliberation and dialogue's potential to ameliorate social and political problems, including polarization and incivility, and to generate more robust and reflective public policy solutions to complex problems. These ideas fold into grander theories of deliberative democracy, which considers how everything from cultural practices to large-scale institutions feed into the overall system of public discourse in a society. Students will review philosophical and interpretive works, as well as empirical research on deliberation utilizing case studies, surveys, and experiments. This seminar also helps students plan and execute their own contributions to this growing body of scholarship.

CAS 515: Rhetoric and Media

3 Credits/Maximum of 9

Seminar in the application of rhetorical theory and criticism to television, film, and other media. CAS 515 CAS 515 Rhetoric and Media (3 per semester/maximum of 9) Seminar in the application of rhetorical theory and criticism to television, film, and other media. In a recent offering of the seminar, we studied the films of Alfred Hitchcock from the point of view of The Rhetoric of the Thriller: The Films of Alfred Hitchcock as Art, Entertainment, and Social Text. This course offered an intensive examination of the art of Alfred Hitchcock, one of the great film artists of the twentieth century. Each week, the class screened one or more of Hitchcock's classic films. The class then met in small discussion sections for intensive analysis of the films and a series of related readings. Our discussions and readings explored Hitchcock as one of Hollywood's most successful popular entertainers, the "master of suspense"; as one of the great artists of the medium; as a critic of American culture; and as a persona whose reputation is a construction of his own efforts, and the product of reviewers and academic critics. Students should consult with the instructor prior to enrolling to ascertain that the course topic is not the same as in prior enrollments.

CAS 530: Political Communication and Media

3 Credits

Study of rhetorical and communicative dimensions of contemporary political communication with particular attention to electronic media. CAS 530CAS 530: Political Communication and Media (3) This seminar explores the rhetoric of electronically mediated political discourse, including broadcast speeches, news coverage of politics and political campaigns, campaign debates, political advertising, talk radio, and political websites. Addressing key problems and issues in democratic theory and practical politics, the seminar explores questions frequently raised by both scholars and political pundits: How has the character of political discourse changed in the age of electronic media? How

have new communicative technologies affected political discourse? Is it possible to have an engaged, informed, and responsible electorate in the age of 30-second spots, ads and journalistic sound bites? What might be done to improve the quality of political discourse and to enhance public deliberation? How might new media technologies be used to combat political alienation and promote civic engagement? The specific focus of the seminar varies by semester. Recent seminars have focused on the rhetoric of presidential campaigns, conceptions of the public and public opinion in the age of mass media and polling, and the political significance of such non-traditional media as motion pictures and websites. Whatever the topic, the focus remains on the impact of mass media on the quality and character of political discourse in America. Students in the seminar will join in a larger scholarly conversation about the impact of new media technologies on democratic politics. Students in CAS 530 will read scholarly works on mass media and politics from a variety of disciplines, as well as more popular writings that have developed influential critiques of contemporary political communication or have advocated reforms in the laws and regulations governing mass media. Given the subject matter, the seminar is necessarily interdisciplinary in approach, and students will be encouraged to take interdisciplinary approaches to their own research and writing for the seminar.

CAS 550: Social Influence

3 Credits/Maximum of 6

Theory and devices of persuasion; analysis of persuasive discourse. CAS 550 CAS 550 Social Influence (3 per semester/maximum of 6) This is a graduate-level seminar designed to provide students with social scientific theoretical principles for explanation, prediction, and practice in social influence contexts and situations. CAS 550 emphasizes the positive and negative outcomes likely to be associated with specific messages designed to influence others in social and societal settings. It emphasizes the importance of audience analysis and goal selection in guiding message design, and source and channel selection to communicate in ways that are intended to form, change, or reinforce and maintain others' beliefs, attitudes, values, and behaviors. It affords significant opportunities to address the gaps between theory and measurement in social scientific research pursuits. These attempts may employ a highly active cognitive approach or a more passive strategy. Both approaches are examined in this course. The course content and setting reflects the above aims. The course begins by defining social influence, provides an overview of its history, and introduces the major theories associated with social influence formation, change, and reinforcement objectives. The course devotes significant time to the evaluation of existing social influence attempts, including review of the channel(s) and source(s) used to deliver particular messages. Students will also practice known strategies for designing influence messages. These activities will take place within the framework of knowledge generated by research findings associated with the influence theories examined in the class. Evaluation will include participation in class, exams that include application in the form of a social influence case study, and a research proposal associated with the application of social influence theories to message design and evaluation. The course complements graduate students' interests in pursuing academic, business, health, management, public relations, advertising, sales, and other career ambitions where communication is associated with the desire to influence others. The course will increase students' critical thinking and informed decision-making skills associated with others' efforts to influence them. It also frames discussion about the ethics of

and ethical decision-making associated with persuasion. CAS 550 will be offered every other year with 15 seats per offering.

Prerequisite: 6 credits in Communication Arts and Sciences

CAS 551: Persuasive Communication

3 Credits

CAS 551 (Persuasive Communication) is a graduate level survey of classic and contemporary thinking on persuasive communication. The overarching goal of the course is to impart an understanding of the major issues and concerns in one of the oldest and most extensive literatures in social science. Students should leave the course with a broad understanding of the content and contours of the field as well as a set of strong empirical generalizations. Because of the enormous role that persuasion plays in shaping contemporary society as well as the day-to-day lives of individuals, an understanding of it is essential for scholars, consumers, and citizens.

CAS 553: Disaster Communication

3 Credits

This seminar provides students with a comprehensive understanding of the multifaceted nature of disaster communication across phases of a disaster.

CAS 554: Small Group Communication

3 Credits/Maximum of 6

Communication variables in small groups. Experimental research and innovations in communication in vocational, therapeutic, and educational groups. CAS 554 CAS 554 Small Group Communication (3 per semester/maximum of 6) Group communication is a specialized area of study that has ties to the related areas of interpersonal and organizational communication. These ties reflect the fact that groups typically are part of some larger organizational structure and that it is the interaction among the members of groups that drive their performance. The major objectives of the course, which is presently offered once every two academic years, are to provide students with (1) an in-depth examination of what social scientific research has revealed about the functions of communication among the members of groups in various interpersonal and organizational contexts and (2) the opportunity to engage in an even deeper examination of a specific issue relating to a specific function of communication in one of the types of groups included, that is, decision-making and problem-solving groups, familial groups, educational groups, work groups, and support groups, by means of an original research project. The first three weeks of the course acquaint students with the general domain of group communication as a specialized area of study, as well as the dominant theoretical and methodological approaches in evidence. In the fourth and fifth weeks, students come to understand how communication in groups functions generally to socialize the members and thereby shape their respective cultures, as well as influence the ways in which they characteristically fulfill the purposes for which they have been created. During the remaining ten weeks of the course, the accent is on particular types of group contexts and the unique ways in which communication is manifested in each. Finally, each student identifies and executes an original research project, the results of which he or she shares with other members of the class in the form of a scholarly paper which, if warranted, he or she subsequently modifies for presentation at a professional conference and possibly publication. Determination of overall mastery of the course content derives from

a student's performance on a comprehensive final examination held during the regularly scheduled final examination period. The grade for the research project and the final examination combined provide basis for the recorded grade for the course. The course requires no special facilities other than a classroom. Students should consult with the instructor prior to enrolling to ascertain that the course topic is not the same as in prior enrollments.

CAS 555: Interpersonal Communication

3 Credits/Maximum of 6

Investigation of the communicative management of ongoing relationships; examination of how communication both creates and responds to exigencies of friendship. CAS 555 CAS 555 Interpersonal Communication (3 per semester/maximum of 6) This course is intended for graduate students who want an in-depth understanding of interpersonal communication across contexts. It is a graduate-level course, so the reading is heavy, the expectations for the level of discussion are high, and the instructor will assume that students have a serious interest in studying research and theory focused on understanding communication processes. Structurally, the course begins with a review of definitional and philosophical issues underlying research and theory in interpersonal communication, then covers the major frameworks and theories that make up knowledge in the area. In addition, some of the primary issues debated in the literature will be discussed. Evaluation methods will include presentations and research paper(s), but may also include exams and participation. Students should consult with the instructor prior to enrolling to ascertain that the course topic is not the same as in prior enrollments.

Prerequisite: CAS 403

CAS 556: Relational Communication

3 Credits

Examines theories and research focused on understanding communication in intimate (or potentially intimate) relationships. CAS 556CAS 556 Relational Communication (3) This course is intended for students who want an in-depth understanding of interpersonal communication in intimate and potentially intimate relationships. It is a graduate-level course, so the expectations for the level of discussion are high and the instructor will assume that students have a serious interest in studying research and theory focused on understanding communication processes in relational contexts. The focus will be on cognitive and social theories of relational encounters, including friendships, romantic relationships, and family relationships. Structurally, the course begins with a review of different philosophical issues underlying research and theory in the field of relational communication. Then, students will shift their attention to the major social scientific perspectives on human relationships. Next, major theories would be discussed and the course would be completed with a more focused discussion of central issues related to relational communication. Evaluation methods will include, research paper(s) and presentations, but may also include exams, short papers, journals, quizzes, and creative activities.

Prerequisite: CAS 403

CAS 557: Health Communication

3 Credits

Provides experience in making decisions about planning, implementing, and evaluating communication in community-based health campaigns to achieve health promotion/education. CAS 557 CAS 557 Health Communication (3) This is a graduate seminar designed to provide students with a comprehensive overview of health communication in community-based health campaigns. Health messages are a pervasive feature of contemporary American life. The study of health communication for community-based campaigns overviews strategies for informing, motivating, and selling ideas and behaviors based on health and health care. Students will select a target community and topic to use as a focal point for applying course readings. Students will prepare an evaluation plan for assessing policymakers' involvement in your health topic. This should include projection of the need for policymakers' involvement, using as many archival materials as possible to conduct a formative evaluation of the need and a plan to obtain the additional information needed to identify the gaps between current and projected levels of involvement. Students will also assess previous efforts to involve lay and expert communities in health promotion efforts associated with their topic, and summarize findings, preparing an organizational membership roster for both Expert Advisory Board and Community Steering Committee, and providing a mission statement to be used in recruitment. Provide a draft of a commitment contract to be signed by board and committee members. Students will also examine previous efforts to involve educational institutions, and lay and expert providers in promotion efforts, summarizing findings and developing a vision of how these audiences should be and could be involved. Previous efforts to involve businesses, retailers, and family in promotion efforts will also be assessed, with development of a vision of how these audiences should be and could be involved included. The health communication seminar complements students' interests in pursuing academic, political, counseling, pastoral, business, health, management, public relations, advertising, sales, and other career ambitions where community-based campaigns comprise an important focus.

Prerequisite: CAS 453

CAS 558: Family Communication

3 Credits

Examines theories and research focused on understanding communication in family contexts. CAS 558CAS 558 Family Communication (3) This course is intended for students who want an in-depth understanding of communication in family relationships. It is a graduate-level course, so the expectations for the level of discussion are high and the instructor will assume that students have a serious interest in studying research and theory focused on understanding communication processes in family contexts. The focus will be on communication theories of family relationships, including parent-child relationships across the life span, sibling relationships, and marital relationships. Students are encouraged to apply this knowledge to their own lives. Students should leave the course with a much more thorough understanding of factors that affect communication within family interaction. Structurally, the course begins with a review of different philosophical issues underlying research and theory in the field of family communication. Then, students will shift their attention to the foundational issues/principles underlying communication in family contexts. Once the course successfully increases student awareness of these foundational principles, the course moves to a focus on

interactions within family settings. As part of this move, the course will address communication in parent-child, intergenerational, marital, and sibling relationships, and will include general topics such as affection and intimacy, conflict, power and control, and strengthening and repairing relationships. Throughout, the course will discuss communication processes within the larger cultural, interpersonal, and communication contexts in which family relationships are situated. Evaluation methods will primarily include exams, paper(s), research projects, and critical thinking reaction papers.

Prerequisite: CAS 405

CAS 559: Lifespan Communication

3 Credits

How various communication processes such as language skills, interpersonal relationship definition and management, social support change cross the lifespan. CAS 559CAS 559 Lifespan Communication (3) Lifespan Communication is a graduate seminar that emphasizes how communication processes (e.g., language skills, interpersonal conflict management, socialization and support, etc.) are developed, maintained and changed across the lifespan. The seminar concentrates upon numerous communicative processes from infancy through childhood, adolescence into middle age, and beyond middle age into later life. Numerous theoretical perspectives that incorporate lifespan principles will guide this seminar. The most recent research that investigates communication across the lifespan will be read and critiqued. This course is grounded in the assumption that multiple disciplines have investigated and continue to investigate human interaction at all points in the lifespan. Therefore, sociological, psychological and anthropological research will complement the research in the discipline of communication that will be discussed in the seminar.

Prerequisite: CAS 403 or equivalent

CAS 560: Communication Theory

3 Credits

This course introduces graduate students to the philosophical underpinnings of communication research and develops skills in theory construction. CAS 560CAS 560 Communication Theory (3) The first Department of Communication was established in the 1950s, and most departments of communication are less than 30 years old. This course is intended for graduate students who want an in-depth understanding of the philosophical issues underlying research and theory in human communication. It is a graduate-level course that emphasizes theory development in the area of human communication behavior. The readings covered are extensive, contributing to an expectation for abstract and integrative thought and discussion. Students should have a serious interest in studying theory construction and related philosophical underpinnings. Structurally, the course begins with a review of definitional issues underlying research and theory in human communication, moves to a focused discussion of various epistemological and ontological positions in the social sciences and humanities, then shifts to issues of theory construction and development. In addition, some of the primary issues debated in the related literatures will be discussed. Evaluation methods will include presentations and paper(s), but may also include exams and participation. As a result, students will examine where knowledge about communication comes from while defining social science, metatheory, theory, and levels of theorizing; acquire familiarity with the breadth, scope, and range of communication theory as a domain of study; comprehend major issues confronting researchers

and theoreticians in communication; and acquire a vocabulary suitable for understanding the discussion that takes place in the field's journals and at communication conferences. The course is planned as a foundational course for all graduate students entering the graduate program with interests in non-rhetorical methods of inquiry, and it is strongly recommended for all students entering the graduate program with interests in non-rhetorical methods of inquiry. This course will be offered once a year with 15 seats per offering.

Prerequisite: CAS 403

CAS 561: Quantitative Research Methods

3 Credits

Introduces graduate students to principles, issues, and design considerations underlying social scientific methodology; material is applied to communication research. CAS 561 CAS 561 Quantitative Research Methods (3) This course is intended for graduate students who want an understanding of the quantitative methodology and research design. It is a graduate-level course, so the reading is heavy, the expectations for the level of discussion are high, and the instructor will assume that students have a serious interest in becoming critical consumers of quantitative research methods. Structurally, the course begins with a review of definitional issues, moves to a thorough discussion of sampling, reliability, and validity in research designs, then shifts to an understanding of quasi-experimental and experimental designs. In addition, some of the primary issues debated in the literature on quantitative methodologies will be discussed. Evaluation methods will include presentations and paper(s), but may also include exams and participation. The course is planned as a foundational course for all graduate students entering the graduate program with interests in non-rhetorical methods of inquiry, and it is strongly recommended for all students entering the graduate program with interests in non-rhetorical methods of inquiry. This course will be offered once a year with 15 seats per offering.

Prerequisite: CAS 403

CAS 563: Pairs & Pairings: Quantitative Methods for Interdependent Data

3 Credits

Foundational course exploring methods for addressing interdependent data: dyadic analysis and social network analysis. CAS 563 Pairs & Pairings: Quantitative Methods for Interdependent Data (3) This graduate seminar is a foundational course exposing students to two quantitative perspectives that are increasingly encountered in the communication research: dyadic analysis and social network analysis. Dyadic analysis and social network analysis attempt to analyze non-independent data, and test concepts such as interpersonal influence, position, role, or social distance and segregation. By the end of the semester students should have an understanding of these perspectives, be able to conduct basic dyadic and social network analyses competently, and be ready to anticipate various boundaries, caveats, and necessary conditions. The ultimate objective of this seminar is to produce informed users and consumers of quantitative research using quantitative methods for handling interdependent data.

Prerequisite: CAS 561

CAS 564: Measurement in Communication Science

3 Credits

This course is concerned with the theory and technology of measuring variables relevant to the study of communication. In a phrase, the course is about construct validity. It consists of three major sections. The first focuses on how to devise and evaluate a conceptual definition, then create a corresponding operational definition. This section lays the groundwork for the subsequent sections that present data-analytic procedures for evaluating the correspondence between concept and operation. Part two of the course addresses measures in which the symbols reflective of the phenomenon are ordered. Specific topics include consistency indices of reliability, exploratory factor analysis, and confirmatory factor analysis. Part three emphasizes measurement of phenomena for which the symbols are not ordered, that is, the measurement of categories. It covers the creation and evaluation of coding schemes as they are used in verbal protocols, content analysis, and social interaction analysis as well as agreement indices of reliability. The overarching goal of the course is to impart some of the conceptual and practical skills necessary for conducting social scientific research.

CAS 565: INTERPERSONAL COMMUNICATION & WELL-BEING

3 Credits

This course is a graduate-level examination of research linking interpersonal communication to outcomes associated with personal well-being. This course is grounded in a biopsychosocial understanding of health, which recognizes that physical and mental health is shaped by social experiences, including interpersonal communication. The course begins by reviewing various indices of well-being, mind-body linkages, and evidence that interpersonal communication produces outcomes relevant to well-being. Next, we explore the literature linking well-being to social support in its various forms, spanning the health benefits of social network involvement to the impact of specific comforting messages. We turn then to the deleterious impact of caustic relationship states and communication episodes representing facets of interpersonal conflict. Throughout the semester, attention will be given to the theoretical issues and methodological challenges that confront researchers working on these topics, and a review of those issues serves as the capstone session for the semester.

CAS 567: Health Campaigns: Design and Evaluation

3 Credits

Theory and methods of message design, audience analysis, evaluation, and ethics in health communication research. CAS 567 Health Campaigns: Design and Evaluation (3) This graduate course explores theories of health communication and approaches to designing and evaluating effective communication campaigns that attempt to address real-world health issues. The real-world health issues may vary from pandemic conditions involving global coordination to specific ones appearing within a smaller, cohesive network in a particular neighborhood. Students will consider theory-driven campaigns targeting audiences who represent a variety of languages as well as co-cultural orientations and identities, in domestic and international settings. Students will learn theories and methods related to audience analysis, campaign design, and program evaluation. This course will cover issues of inference, ethics, and sources of bias in health campaign design and evaluation.

CAS 581: Discourse Analysis

3 Credits

Overview of theories and approaches to the analysis of spoken and/or written discourse. APLNG 581 APLNG (CAS) 581 Discourse Analysis (3) This course is designed to provide an overview of the various theories of and approaches to the analysis of spoken and written discourse, e.g., speech act theory, conversation analysis, pragmatics, contextual analysis, functional/cognitive grammar, grammar and interaction. These and other approaches are intended to serve as analytic tools and frameworks for students to ultimately design and carry out their own research projects within the course of the semester. Research projects may focus on any aspect of language use, such as language and grammar, language and interaction, language and culture, language socialization, language and cognition; projects may center on some phenomenon of English or may involve other languages, as long as the student is capable of conducting an in-depth analysis of the particular phenomenon under investigation in that language.

Cross-listed with: APLNG 581

CAS 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers. CAS 590CAS 590 Colloquium (1-3) The CAS Colloquium provides a forum for the presentation of graduate student and faculty research, as well as for discussion of professional issues, such as preparing a curriculum vitae or teaching portfolio, publishing scholarly work, applying for grants, and interviewing for academic positions. All first-year graduate students register for the colloquium, and graduate students at all stages of their career are strongly encouraged to attend.

CAS 594: Research Topics

1-12 Credits/Maximum of 12

Supervised student activities on research projects identified on an individual or small group basis.

Prerequisite: prior approval of proposed assignment by instructor

CAS 595: Internship

1-9 Credits/Maximum of 9

Supervised off-campus, nongroup instruction.

Prerequisite: prior approval of proposed assignment by instructor

CAS 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

CAS 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

CAS 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

CAS 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

CAS 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Students enrolled will, under supervision, teach SPCOM 100—introduction to speech communication: formal speaking, group discussion, analysis and evaluation of messages.

CAS 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

CAS 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

Communication Sciences and Disorders (CSD)

CSD 500: Research Methods in Communication Sciences and Disorders

3 Credits

Methodology necessary for understanding and conducting research in communication disorders.

Prerequisite: 15 credits in communication sciences and disorders

CSD 520: Physiologic and Acoustic Issues in Speech Science

3 Credits

Seminar in the physiologic and acoustic aspect of normal and disordered speech production. CSD 520CSD 520 Physiologic and Acoustic Issues in Speech Science (3) CSD 520, Physiologic and Acoustic Issues in Speech Science (PHSIO-ACS SPCH SCI), is a 3-credit course offered every Fall semester. The course is required of all CSD graduate students working towards a masters degree in Communication Sciences and Disorders. The educational objectives of the course are to provide information on acoustical and some physiological aspects of normal speech production, along with some applications to disordered speech production, particularly neurogenic speech disorders, stuttering, and voice disorders. The goal of the course is to provide the graduate student with experience using the most common methods of speech analysis in the research laboratory and the clinic. Because of the frequent use of audio recording equipment in the field, the emphasis is on acoustical analyses for measurement of vowel and consonant properties. Considerable emphasis is placed on coarticulation. Assessment is based on student projects including vocal fundamental frequency analysis, electroglottographic analysis, acoustic analysis of articulation, analysis

of vowels of typical speakers as well as vowels of speakers who stutter, and acoustical analysis of consonants.

Prerequisite: 12 credits in communication sciences and disorders

CSD 540: Phonological Disabilities

3 Credits

Speech-sound production disorders in children and adults; methods of examination, diagnosis, and treatment. CSD 540CSD 540 Phonological Disabilities (3) CSD 540, Phonological Disability (PHONOL DISABILITY), is a 3-credit graduate course typically offered every spring semester. The course is required of all graduate students pursuing a masters degree in Communication Sciences and Disorders. The course has two prerequisites, CDS 442, Introduction to Disorders of Articulation and Phonology and CSD 495A, special topics in phonetics. The objectives of the course are to develop an attitude of critical thinking in the areas of phonological disorders. Class discussions, tests, and projects promote synthesis of ideas. In addition, the course integrates research and practice and a portion of class meetings is spent relating research findings to clinical practice in the treatment of phonological disorders. Original articles focusing on treatment of phonological disorders are required reading. Class sessions and independent and group projects emphasize the assessment and analysis of speech produced by children with disordered phonological systems and assist students to utilize clinically efficient speech sample collection and transcription procedures that optimize the reliability, validity, and potential informativeness of obtained data. Activities involving treatment planning are utilized to assist graduate clinicians in designing efficacious treatment, predicting outcomes, and determining effectiveness of intervention. Student performance is evaluated through tests, take-home projects, critique writing, and inclass projects and quizzes.

Prerequisite: CSD 442

CSD 541: The Voice and Its Disorders

3 Credits

Physical, physiological, and psychological bases of voice production; causes, nature, and symptoms of its disorders; current clinical methods in voice improvement. CSD 541CSD 541 The Voice and Its Disorders (3) This course presents information on vocal function for speech and the disorders that are common to the human vocal folds. During the first section of the course, the physical, physiological, and psychological bases of voice production are discussed along with the causes, nature, and symptoms of voice disorders. Voice disorders are difficult to understand without adequate demonstrations; therefore, the class uses videotapes and voice samples to help foster understanding of the course material. The first portion of the course also includes a review of the anatomy and physiology of the voice and vocal acoustics and extensive coverage of various laryngeal pathologies. Second, voice evaluation and diagnosis are examined including VisiPitch training, electroglottography, endoscopy and stroboscopy. Third, specific clinical management techniques are examined including treatment for vocal abuse and laryngeal muscle tension reduction. Alaryngeal voice disorders are examined including pre- and post-operative counseling and tracheoesophageal speech and voice prosthetics. Finally, neurological disorders of the voice and resonance disorders are examined.

Prerequisite: CSD 444

CSD 542: Fluency Disorders

2 Credits

The purpose of this course is to analyze modern theories of causes of disorders of rhythm in speech; methods of examination, diagnosis, and treatment in fluency disorders; and, the supporting evidence-based practice research. Topics covered include facts about stuttering and its core behaviors, the etiology of stuttering, the development of stuttering. Furthermore, students learn to evaluate stuttering behaviors and to work as part of an interdisciplinary team. Students will learn to evaluate and treat preschool children, school-age children and adults who stutter. In addition, other types of fluency disorders are covered.

Prerequisite: CSD 442 , CSD 495A

CSD 543: Craniofacial Anomalies: Cleft Lip and Cleft Palate

1 Credits

This course enhances graduate students' understanding of the following topics: 1) velopharyngeal mechanism and function for speech production in individuals with and without cleft palate and craniofacial anomalies; 2) basic embryological development related to the lip and palate fusion process; 3) common genetic syndromes that involve cleft palate; 4) in-depth understanding of resonance disorders; and 5) assessment and treatment of resonance disorders.

CSD 545: Neuromotor Disorders of Speech

3 Credits

Etiology and symptomatology of dysarthric and apraxic speech: diagnosis, treatment, and the team rehabilitative program approach to these disorders. CSD 545CSD 545 Neuromotor Disorders of Speech (3) In this course, students gain basic knowledge of neurological bases for speech-motor control. Students learn to identify and describe diseases/conditions that result in acquired and developmental motor speech disorders. Students learn to identify and describe the dysarthrias in clinical populations across the age span. Emphasis is placed on the development and implementation of appropriate intervention plans to remediate and/or compensate for motor speech disorders. Students complete three examinations during class and write a paper that synthesizes current research on a topic in motor speech disorders.

Prerequisite: CSD 444

CSD 546: Language Disorders in Adults

3 Credits

Nature, etiology, diagnosis, and management of language disorders in adults. CSD 546CSD 546 Language Disorders in Adults (3) This course provides information about the disorders of language that result from impairments to the central nervous system. Basic neurology, the aging process, and the nature and cause of aphasia-producing conditions are covered along with issues related to the assessment and management of adults with aphasia. Stroke-related aphasia in adults is the emphasis of this course, but it also briefly covers other common language and cognitive neuropathologies of traumatic brain injury, Alzheimer's Disease, and right-hemisphere brain damage.

Prerequisite: 9 credits in communication sciences and disorders or related fields such as psychology, linguistics, or human development.

CSD 547: Language Disorders in Children

3 Credits

This course provides students with a strong foundation in the nature of language disorders, the current issues in and theories of language disorders, assessment and intervention, and key language assessment and intervention approaches. Major topics include assessments and interventions with infants, toddlers, preschoolers, school-age children, adolescents, children from diverse cultures, and children with communication disorders as the result of autism spectrum disorder, cerebral palsy, and intellectual disability. As a result of the foundation laid in this course, students will be able to critically evaluate and apply the current literature and forthcoming research to their clinical practice.

Prerequisite: CSD 300

CSD 548: Dysphagia

3 Credits

Understanding the process of the swallowing mechanism and the management and treatment of swallowing disorders. CSD 548 Dysphagia (3) This course is designed to provide graduate students with basic knowledge of the swallowing process/mechanism. A brief overview of normal swallowing from birth to the aging adult will be presented. The course will focus on assessment, management, and treatment of individuals who present with a swallowing disorder. Students will become familiar with both non-instrumental assessments of swallowing, and will interpret videofluoroscopic swallowing studies (VFSS). Students will also develop treatment plans for case study patients with dysphagia, Multicultural issues related to swallowing will be discussed.

Prerequisite: CSD 444 or equivalent

CSD 549: Speech-Language Pathologists in the Schools

3 Credits

Topics concerning service delivery in the school setting; legislation related to service delivery, special education enrollment, collaboration, caseload management, special populations. CSD 549 CSD 549 Speech-Language Pathologists in the Schools (3) This course covers multiple aspects related to becoming a competent speech-language pathologist in the public school system. Topics include: legislation related to school-based service delivery; the hierarchy of special education enrollment; considerations for special populations; caseload management and logistical aspects of work in the public school system., Case examples, class discussion, and group activities will be used to illustrate various aspects of this work setting.

CSD 550: Seminar in Communication Sciences and Disorders

1-6 Credits/Maximum of 6

Advanced study of special problems and new developments in communication sciences and disorders. CSD 550CSD 550 Seminar in Communication Disorders (1-6) This seminar is designed to address special topics of interest to doctoral students in the Communication Sciences and Disorders. Topics covered vary from semester to semester and include the art and science of grant writing; various research approaches such as qualitative research methods or single-subject experimental research methods, etc.; issues related to teaching at the university level, speech perception, neuroscience, cognitive science, and cochlear implants.

CSD 551: Assessment and Intervention in Augmentative and Alternative Communication

3 Credits

Research results in augmentative and alternative communication (AAC); implications for assessment, prescription of AAC systems, and intervention planning in AAC. CSD 551 CSD 551 Assessment and Intervention in Augmentative and Alternative Communication (3) In this course students examine current applications of augmentative and alternative communication (AAC) including unaided and aided AAC systems. Students critically evaluate the strengths and limitations of these systems, identify the skills required to use these systems, and describe individuals who may benefit from AAC. Many topics of importance to AAC are studied including key legislation related to people with disabilities, consumer-responsive services and strategies to effectively implement services that are consumer-responsive. Clinical management is emphasized and students determine appropriate AAC assessment goals, procedures, and tools to identify the communication needs of individuals who require AAC, assess their skills and determine opportunity barriers. Students customize AAC systems to meet the needs of individuals who require AAC, determine partner strategies to enhance communicative interaction with individuals who use AAC and use empirically-validated instructional procedures to teach these strategies to partners. Students evaluate the efficacy of AAC interventions and determine consumer satisfaction. To accomplish these goals, students complete laboratory assignments and written case assignments in AAC assessment, vocabulary selection, and intervention planning and implementation.

CSD 595E: Audiology Practicum

1-5 Credits/Maximum of 5

CSD 595E CSD 595E Audiology Practicum (1-5) This course provides speech-language pathology graduate students with a detailed and pragmatic understanding of hearing testing, normal and abnormal auditory systems, and common practices used to evaluate hearing ability. Students will gain experience in pure-tone audiometry, tympanometry, speech audiometry, central auditory processing disorders, and otoacoustic emissions. Students participate in hearing aid fittings, programming and repairs. Students learn to interpret the results of audiological evaluations and make appropriate recommendations based on results of audiological evaluations.

CSD 595G: Speech Diagnostics Practicum

1-3 Credits/Maximum of 3

CSD 595G CSD 595G Speech Diagnostics Practicum (1-3) In this practicum course, advanced speech-language pathology graduate students gain experience in interviewing clients, parents and spouses. They learn to counsel clients and their families regarding communication disorders. With supervision, students complete diagnostic evaluations for a broad range of communication disorders and synthesize data. Report writing is also emphasized.

CSD 595J: Audiology Third Site

1-2 Credits/Maximum of 2

Internship course.

CSD 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

CSD 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

CSD 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

CSD 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

CSD 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

No description.

Prerequisite: 40 graduate credits in CMDIS

CSD 603: Foreign Academic Experience

1-12 Credits/Maximum of 12

For students who are enrolled in a foreign university, or foreign study and/or research and constituting progress towards the degree.

CSD 610: Thesis Research Off-Campus

1-9 Credits/Maximum of 999

No description.

CSD 850: Endoscopy Lab

1 Credits

This lab-based course will provide students the unique experience of manipulating rigid and flexible endoscopes for assessment of the velopharynx, larynx and swallow anatomy and physiology. There will be hands on practice in a small group setting with direct instruction from experts in the field of laryngology. Students will have opportunity to learn and refine skills for interpretation of stroboscopy and flexible endoscopic evaluation of swallowing (FEES).

CSD 851: Head and Neck Cancer Management

2 Credits

This course covers the unique challenges of evaluating and treating speech, voice, and swallowing disorders resulting from treatment for head and neck cancer. A basic understanding of the causes of and surgical/chemoradiation treatments for various types of head and neck cancers will be obtained. Emphasis will be placed on communication and

swallowing evaluations and rehabilitation following cancer treatments. A team approach to patient care will be stressed.

CSD 852: Lab in Augmentative and Alternative Communication Technology

3 Credits

This course provides in-depth, applied consideration of Augmentative and Alternative Communication and Assistive Technology. It builds knowledge and skills in the areas of system design and the interplay between person and technology; maximizing participation through understanding of barriers and supports at multiple levels; and training and supporting all stakeholders. Students will engage in (a) hands on learning of assistive and AAC technologies that support communication and participation across all environments; (b) discussions of research related to use of assistive and AAC technology to enhance communication and curriculum outcomes for individuals with disabilities; and (c) problem-based learning through case studies in order to apply their knowledge and skills

CSD 853: Professional Development for Speech-Language Pathologists and Audiologists

1 Credits

Medical terminology is a course for students preparing for the Communication Sciences and Disorders profession with the target of giving exposure to medical terminology, documentation, types of insurance consistent with this field, and interactions with other medical disciplines. A variety of medical settings will be discussed. The code of ethics and scope of practice within a medical setting as determined by the American Speech and Hearing Association (ASHA) will be included.

CSD 854: Tracheostomy and Ventilator Lab

1 Credits

This lab-based course covers the unique challenges of evaluating and treating speech, voice, and swallowing impairments demonstrated by patients requiring tracheostomy tube placement with and without mechanical ventilation. Hands-on education will include task training with various tracheostomy tubes, oneway speaking valves, and ventilators/ventilator settings; as well as interprofessional case studies using high-fidelity mannequins and simulated patient modalities/technologies.

CSD 895A: Speech/Language Clinical Practicum

1-3 Credits/Maximum of 15

This course covers clinical diagnostics and intervention practices across the lifespan with individuals with a variety of communication disabilities. Students will have the opportunity to develop their clinical knowledge and skills by accruing practicum hours. The number of clinical hours assigned each semester depends on the number of credits being taken as well as the number and types of hours that need to be accrued to meet certification requirements. The graduate student will attend one weekly meeting with each supervisor with whom a client is assigned. Additionally, this course includes a weekly class lecture, providing instruction in and application of diagnostic and therapy procedures. Topics covered include interviewing clients, parents, and spouses, counseling clients and their families, clinical teaching, and activities to enhance teaching and learning. Students also learn appropriate

methods of report writing, data collection, writing clinical objectives, and intervention plans.

CSD 895C: Speech/Language Therapy Externship

7-15 Credits/Maximum of 15

This course is a full-time externship experience in the assessment and treatment of communication disorders and is completed at an off-campus site. Graduate students in Communication Sciences and Disorders participate in an active learning clinical practicum with working professionals to enhance their academic and clinical competencies and skills. Students will accrue required clinical practice hours in an off-campus clinical and/or educational setting including hospitals, rehabilitation centers, nursing homes, early intervention programs, and public schools including pre-school programs.

Prerequisite: 45 credits in communication sciences and disorders and accrual of >200 clinical hours

CSD 895G: Speech Diagnostics Practicum

1-3 Credits/Maximum of 3

CSD 595G/CSD 595G Speech Diagnostics Practicum (1-3) In this practicum course, advanced speech-language pathology graduate students gain experience in interviewing clients, parents and spouses. They learn to counsel clients and their families regarding communication disorders. With supervision, students complete diagnostic evaluations for a broad range of communication disorders and synthesize data. Report writing is also emphasized.

CSD 895I: Speech Pathology Mini-Placement

1-9 Credits/Maximum of 9

Graduate students in Communication Sciences and Disorders participate in an active learning clinical practicum with working professionals to enhance their academic and clinical competencies and skills. Students will accrue these required clinical practice hours by completing this mini-placement in an off-campus clinical and/or educational setting including hospitals, rehabilitation centers, nursing homes, early intervention programs, and public schools including pre-school programs.

Communications (COMM)

COMM 501: Proseminar in Mass Communications

3 Credits/Maximum of 3

Overview of paradigms in mass communications research

Prerequisite: admission to doctoral program

COMM 502: Pedagogy in Communications

3 Credits

The purpose of this seminar is to train doctoral students to teach in the communications discipline at the college/university level. COMM 502 Pedagogy in Communications (3) This seminar is proposed as a dimension of the emphases on TA training and teacher preparation for doctoral students in Mass Communications in the College of Communications. The course is one aspect of the College's Graduate Teaching Academy. The seminar provides a foundation in pedagogical research, theory and classroom practice for mass communications

doctoral students. The Graduate Teaching Academy demonstrates our faculty's commitment to the integration of training in research and teaching. The work of the seminar focuses on the unique characteristics of undergraduate and graduate education in the communications discipline. The principles and practices covered in the seminar have applications for teaching communications in a number of venues including the academic, business and government professional settings. The course involves students in collaborative learning, assessment skills, powerful pedagogies, practical workshops and substantive reviews and applications of curricular and pedagogical research in the communications discipline. The Graduate Teaching Academy in the College of Communications involves students in a number of activities that will prepare them for teaching. This seminar is one of those activities. Graduate Teaching Academy participants: 1. Take coursework in communications curriculum and pedagogical development that stresses a teaching scholarship of learning theory and a pedagogy of active and engaged learning practices. 2. Study the scholarship of learning within a disciplinary context in order to understand the system of organized knowledge in the communications discipline within which our teaching takes place. This orientation encourages a critical review of the comparative costs/benefits of a disciplinary - versus interdisciplinary-based communications pedagogy. 3. Eligible doctoral students become Teaching Associates, under faculty supervision, for selected College of Communications courses 4. Teach an undergraduate course in the College as an instructor. 5. Develop a teaching portfolio. 6. Attend College colloquia. 7. Have access to College resources like the Academic Services Center, the Office of Multicultural Affairs, and University resources such as the Center for Excellence in Learning and Teaching at Penn State's Schreyer Institute. 8. Complete the Teaching with Technology certification.

COMM 503: Feminist Media Studies

3 Credits

This course will explore key intellectual traditions, theoretical concepts, research methods, and axiological elements that inform research in feminist media studies. Course readings will be inter/trans/ disciplinary so that students may gain a sense of the field of feminist media studies, its influences, and its possibilities. Readings and assignments may relate media studies with: feminist histories; transnational feminism; feminist political organizing and activism; queer studies; feminist approaches to masculinity, race, ethnicity, labor and production; sexual violence and harassment; relationships between feminist scholarship and other critical studies of culture, audience and reception studies, science and technology studies, rhetoric, political economy, and history.

Cross-listed with: WMNST 503

COMM 504: Seminar in the History of Mass Communication

3 Credits

No description.

COMM 505: International Communication Problems

3 Credits

Legal and communications problems of the international flow of news and opinion; international press codes.

COMM 506: Research Methods in Communications

3 Credits

The scientific method; survey of basic concepts of theoretical and empirical research; variety of methodology; criteria for adequate research. COMM 506 Introduction to Mass Communications Research (3) COMM 506 provides an overview of and foundation in research. Students are exposed to the nature of scientific inquiry, the process of concept explication, operationalization, measurement, and sampling. They also learn how to ask a research question. Research ethics, the logic and mechanics of experimental methods, fundamentals of survey design, and content analysis are also discussed. Students demonstrate the concepts learned in class by completing their own research project. Students also are exposed to statistical logic and practice in the context of their own project.

COMM 507: News Media and Public Opinion

3 Credits

Problems in the function, techniques, and responsibilities of press, radio, and television in forming and interpreting opinion.

COMM 511: Qualitative Research Methods in Mass Communications

3 Credits

This course focuses on the nature of qualitative research methodology for studying mass/mediated communication topics and to relevant research techniques. There is special emphasis on qualitative epistemology, ethnographic approaches, interviews, focus group, textual analysis, and mixed-method approaches.

Prerequisite: COMM 506

COMM 512: Government and Mass Communications

3 Credits

Problems of freedom of information; governmental efforts to control mass communication agencies; government news coverage; public information agencies.

COMM 513: Constitutional Problems of the News Media

3 Credits

Problems involving conflict between guarantees of press freedom in the First and Fourteenth Amendments and rights and privileges of others.

COMM 514: Political Economy of Communications

3 Credits

Structure and functions of United States and global media systems and their relationship to political and economic systems.

COMM 515: MA Proseminar in Mass Communications

3 Credits

An introduction to graduate studies for MA students in Media Studies and Telecommunications Studies.

Prerequisite: First semester enrollment in MEDIA or TELEC M.A. programs

COMM 516: Introduction to Data Analysis in Communications

3 Credits

To understand and be able to use data analysis techniques common to research in communications. COMM 516 Introduction to Data Analysis in Communications (3) This class serves as an introduction to data analysis techniques commonly employed in the field of communications and in related disciplines. The course will employ a commonly-used statistical package to illustrate concepts (e.g., Statistical Package for the Social Sciences, SPSS), and instruction will be provided on how to employ statistical software to conduct a variety of specific analysis techniques. These techniques will include descriptive statistics, analysis of variance, correlation and regression, and exploratory factor analysis. Examples of research from the communications discipline and related fields will be used throughout the semester to illustrate concepts. Emphasis will be placed on decisions involved in the data analyses process, interpretation of data, and effective presentation of results in journal-article format. Evaluation will be based on short take-home assignments, exams, and a final paper.

Prerequisite: COMM 506 or consent of program

COMM 517: Psychological Aspects of Communication Technology

3 Credits

Investigation of psychological aspects of human-computer interaction (HCI) and computer-mediated communication (CMC). COMM 517 Psychological Aspects of Communication (3) This graduate seminar is devoted to the investigation of psychological aspects of human-computer interaction (HCI) and computer-mediated communication (CMC). Theories and empirical research from communication, psychology, and human-computer studies will be used to explore social responses to communication technologies; uses and effects of unique technological features such as interactivity and navigability upon individual users' thoughts, emotions, and behaviors; nature and dynamics of interpersonal and group interaction when mediated by technology; how issues of "source" and "self" are altered by computer-based media; and psychological consequences of internet use, such as addiction and depression. A primary goal of the seminar is to draw out, through readings, discussion and empirical exploration, fundamental theoretical and practical implications of these lines of research for interface design, psychological processing of mediated form and content, human-web site interaction, and internet-based mass, group and interpersonal communication.

Prerequisite: COMM 304 or COMM 506

COMM 518: Media Effects

3 Credits

Advanced study of the effects of media messages and technologies via theories and empirical evidence pertaining to processes of effects.

Prerequisite: COMM 506 or permission of instructor

COMM 519: Data Models in Communications

3 Credits

The purpose of this course is to further students' understanding and application of complex data analytic techniques in communications research and related disciplines. Topics of importance to the discipline will be covered using applied, hands-on, and contextualized approaches.

These topics will focus on the analysis of covariance structures, including extensions of multiple regression, path analysis, measurement structures, and structural equation modeling. Additional issues in alternate semesters may include such topics as hierarchical linear modeling, network analysis, or meta-analysis. This course will stress an applied focus, addressing frequently encountered issues and questions arising in common experimental and correlational contexts. Additionally, students will become familiar with commonly used software employed in the analysis of data. Examples will drawn from and will illustrate frequently employed approaches in such areas as advertising, telecommunications, new technologies, media effects, public relations, political communication, computer-mediated communication, and gaming studies, among other.

Prerequisites: COMM 506, COMM 516

COMM 520: Seminar in Advertising Problems

3 Credits

No description.

COMM 521: Advertising Perspectives

3 Credits

An overview of advertising in industrial societies including institutional issues; socio-demographic issues; public policy issues; and ethical issues.

COMM 522: Social and Cultural Aspects of Advertising

3 Credits

Analysis of advertising from a cultural/literary perspective; emphasis on semiotic and hermeneutic analysis; advertising as social communication.

COMM 530: Research Methods in Strategic Communications

3 Credits

The purpose of this course is to provide students with an understanding of the methods and practices used to conduct effective research in examining practical and theoretical questions in strategic communications. Successful strategic communications campaigns are informed by research conducted before (planning), during (monitoring), and after (evaluation) the implementation of the campaign. Further, research based on theoretical models can help understand and explain the effects of strategic communications on consumers, individuals, and society. This course will be organized so that students will (1) gain exposure to a breadth of methods used by industry and academic researchers; (2) understand the role of theory in informing strategic communications research and its applications; (3) gain depth and experience in several research methods and techniques; and (4) conduct research and obtain research-writing experience, in either academic or professional venues. Students also will learn how to use databases employed by strategic communications researchers to conduct audience/consumer analysis and media research. A range of specific research methods will be discussed, with emphasis placed on trends or contemporary developments in research. In addition to examining the principles, methods, and techniques of strategic communications research, the course will address issues such as when research should or should not be conducted, analyzing data sets, forming meaningful research questions, determining the proper means to answer the

questions, and presenting the results and solutions in a clear and compelling manner.

COMM 531: Strategic Communications: Theory and Implementation

3 Credits

This course provides students with a comprehensive understanding of professional strategic communications via examining key theoretical and conceptual fundamentals of persuasive communication, attitude formation and change, and mass communication, while examining applied implications that affect the strategic communications industry. Students in this course will be: 1) exposed to academic research that analyzes and explains how and why the implementation of strategic communication works, and 2) shown how this information can be tested, extended, and applied to goal-oriented communication campaigns. Through comprehending both the theoretical underpinnings of strategic communications practices and their proper application, students will gain valuable knowledge that applies to both scholarly pursuits – which help to develop theory and knowledge – and professional pursuits, in which theoretical advancements can provide real-world solutions. Strategic communications professionals need to comprehend a wide range of theoretical frameworks to understand how theory and research can inform the implementation of communications plans and decision-making. Students in this course will gain knowledge in traditional and contemporary academic research that examines the mechanisms of persuasive and mass communication in affecting consumers' beliefs, attitudes, and behaviors. Students will examine the interplay of these theories and identify key gaps in the literature and/or untested potential relationships that could help better explain how strategic communications plans work or should work. Based on this insight, students will apply their theoretical knowledge to realistic industry situations and will be able to offer specific suggestions and communication strategies to solve actual problems. Students will learn how the implementation, testing, and extension of relevant theory can guide precise strategic-communications decisions and strategies that lead to specific outcomes among varied target audiences and consumers. The material covered in this course forms the foundation of understanding how the field of strategic communications functions and how this knowledge can be advanced and applied to achieve desired, communication-based results for any entity.

COMM 550: Film Theory and Criticism

3 Credits

Studies in traditional and contemporary film theory and criticism. COMM 550 Film Theory and Criticism (3) COMM 550 seeks to introduce students to a variety of theoretical approaches to the critical analysis of film. The course devotes attention to aesthetic as well as social, cultural, political and economic issues, assuming that they are, in fact, inseparable. It involves viewing films closely, and researching the contexts of their production and reception. It stresses critical thinking, reading, viewing and writing skills. COMM 550 assumes that films can reveal, both directly and indirectly, something about the experiences, identity, and culture of the people who produce and consume them. That is, movies can be analyzed—even psychoanalyzed—to reveal something about the cultural conditions that produced them and attracted audiences to them. The course seeks both to familiarize students with works they probably haven't seen, and to "defamiliarize," through critical and historical analysis, works they very well may have seen. Films are examines as formal constructs, market commodities, and cultural artifacts. Individual instructors may emphasize film authorship,

styles, genres, systems or cycles. They may focus on the context, text or reception of a film, filmmaker, or group of films. The emphasis of COMM 550 is always on the self-conscious, theoretically informed analysis of cinematic texts.

COMM 553: Special Problems in Film and TV

1-3 Credits/Maximum of 99

No description.

COMM 555: Media and Culture

3 Credits

An overview and history of critical theories that aim to explain the relationship between media and culture. COMM 555 Media and Culture (3) This course will provide an overview of the major theorists of mass media whose work offers critical appraisals of the impact of mass media on cultures and the people within those cultures. It will give students an understanding of the major theorists and their conceptions of the relationship between media, communication and culture. Each section is designed to interrogate a particular epistemological or methodological challenge to the social and cultural understanding of mass media, from the seminal thinking of the Frankfurt School - the first thinkers to engage this important field of research - through the theorists of the so-called post-modern turn. Special attention will be paid to examining the ways in which mass media constructs ideological foundations for society's understanding of democracy, identity and everyday life.

COMM 556: Reading Film

3 Credits/Maximum of 12

A practical and historical approach to film theory and analysis. This seminar develops critical visual literacy by examining a range of practices in cinema study, with emphases on the relation of film to literature and the analysis of film meaning. The course asks how to read a film, and considers the multiple ways that films combine framing, movement, editing, narrative, character, and genre toward the production of culture, ideology, identity, desire, poetic imagery, and community. Students will explore a wide range of critical methods, and will view one to two films per week. Readings will range from novels to classic film theory, cultural studies, belles-lettres, film criticism, radical poetics, apparatus theory, media theory, and contemporary philosophy.

Cross-listed with: ENGL 556, VSTUD 556

COMM 557: Internet Cultures

3 Credits

This course will examine topics of relevance to internet as culture, including several online communities - writers of fanfiction, gamers, and trolls are among the possibilities -- as case studies of the larger phenomenon. It will explore methods of studying such topics and communities, with a focus on netnography and thick description, and raise questions about privacy, anonymity, ethics and aesthetics. The class will examine the latest trends in internet cultures and research, including such topics as online misogyny, trolling, citizen journalism, internet folklore, and digital activism.

COMM 580: Seminar in Telecommunications

3 Credits

Study of the historical and contemporary issues and problems in telecommunications.

COMM 582: Ethics and Emerging Communications Technology

3 Credits

Identification and analysis of ethical issues raised by electronic communications technologies.

COMM 584: International Telecommunications and Trade Policy

3 Credits

An interdisciplinary perspective that investigates contemporary debates and ongoing or anticipated conflicts in international telecommunications and trade policy. COMM 584 International Telecommunications and Trade Policy (3) The study of international telecommunications policy requires an interdisciplinary perspective. Students should understand the past and present technological, business, philosophical, geopolitical and legal environment. Success in either the public or private sectors may depend on one's ability to anticipate and react to future trends and upheavals. The course presents, investigates and debates ongoing or anticipated conflicts in international telecommunications and trade policy. The resulting confrontations may stem from technological innovation, real or perceived changes in the marketplace, or the imperatives of prevailing regulatory, political or economic philosophies. Conflict resolution often results from persuasive advocacy, coalition building, and accommodation of outsiders with new perspectives or entrepreneurial visions, rather than applying legal precedent or treaty interpretations. The course also will examine how various nations have organized and reorganized the telecommunications sector. We will consider such developments as privatization, liberalization, deregulation and globalization. Faculty: Rob Frieden

COMM 585: Media & Telecommunications Industries

3 Credits

Study the structure and performance of media, telecommunications and information industries applying principles and ideas from microeconomics, finance and communications. COMM 585 COMM 585 Media & Telecommunications Industries (3) The objective of this graduate seminar is twofold. First, the course provides exposure to the applications of selected concepts, principles and topics in microeconomics to the analysis of the media, telecommunication and information markets. This course is not intended as a general introduction to microeconomic theory and practice - however, students will have the opportunity to begin their study of selected applications of microeconomic principles at a fundamental level and advance their understanding to a high level of complexity worthy of graduate coursework. The second objective of the course is to connect ideas and principles from microeconomics to a body of communications theories, demonstrating possible complements and conflicts across the two disciplines. Discussion of both theoretical and empirical scholarship is emphasized. This in turn gives students a framework for further research on the structure of information industries and the conduct and performance of communications firms. Course covers international markets but focus is on North America. Topics may include selected industries such as wired and wireless telephony, satellite communications, broadband/cable, broadcasting, film, advertising,

publishing, computing and Internet; industrial organization; competition and competitive advantage, growth and the economic causes of innovation; economics of intellectual property protection; electronic markets, hierarchies and transactions cost economics; the economic justification and effects of regulation; natural monopoly economics; cost modeling, demand forecasting and pricing in regulated monopoly and competitive industries; telecommunications deregulation and privatization.

COMM 587: Internet Law and Policy

3 Credits

Examination of legal, policy and business developments in Internet-mediated communications emphasizing the impact on existing regulatory and economic models. COMM 587 COMM 587 Internet Law and Policy (3) This course will provide a forum for students to investigate and debate ongoing or anticipated conflicts in Internet-mediated telecommunications, information processing and commerce. The resulting confrontations may stem from technological innovation, real or perceived changes in the marketplace, or the imperatives of prevailing regulatory, political or economic philosophies. Conflict resolution often results from persuasive advocacy, coalition building, and accommodation of outsiders with new perspectives or entrepreneurial visions, rather than applying legal precedent or treaty interpretations. Internet mediation has the potential to change how we communicate, educate, inform, entertain, and transact business. Technological and marketplace convergence means that Internet mediation will have a profound impact on many legal, regulatory and economic constructs, i.e., the pre-existing templates we use to describe and understand the communications process and impact on individuals and society. The course also will examine the growing body of cases that have addressed aspects of Internet-mediation in each of the following general categories: ♦ Speech - commercial and political speech, obscenity, forums analysis; ♦ Legal and Regulatory Consequences of Convergence - the juxtaposition of telecommunications and information processing technologies, markets and regulatory regimes; ♦ Governance and regulation of the Internet - whether the need exists for government intervention on such matters as numbering and domain name registration; ♦ Intellectual Property Rights - the impact of Internet-mediation on copyright, trademark and patent laws; ♦ Electronic Commerce - the law and policy of Internet-mediated transactions; privacy and encryption concerns; and ♦ Equity, Competition Policy and Consumer Protection Concerns what, if anything, should governments do to remedy market failures.

COMM 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

COMM 594: Research Topics

1-15 Credits/Maximum of 15

Supervised student activities on research projects identified on an individual or small-group basis.

COMM 595: Internship

1-18 Credits/Maximum of 18

Supervised off-campus, non-group instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

Full-Time Equivalent Course

COMM 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

COMM 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

COMM 597B: **SPECIAL TOPICS**

3 Credits

COMM 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

COMM 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

COMM 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 3

Teaching or assisting in School of Communication courses by graduate students with previous news-editorial, advertising, and broadcasting experience.

COMM 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

COMM 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

COMM 830: Strategic Communications Industry

3 Credits

Technology is transforming the strategic communications industry. COMM 830 provides students with an overview of the merging of the advertising, public relations, and corporate communications industries. Students will learn how digital technology has transformed paid, earned, and owned media. Students will explore the transformation of audiences

from passive users to active and interactive media-savvy consumers. Special emphasis will include the global and ethical impacts of evolving strategic communication. Students will explore the industry structure as it has evolved from traditional media to the development of the digital media landscape from the internet, Web 2.0, and the post-PC era. The course also provides an overview of strategic communications as it applies to agency, firm, government, corporate, and nonprofit organizations. Students will gain an understanding of the analog and new media landscape and will develop an understanding of the economic and financial indicators that drive the present industry. The course will explore how traditional media practices are impacted by technology as well as the impact of technology on entrepreneurial opportunities for industry practices from broadcast and digital to print, advertising, journalism, and public relations. The course will examine the roles and characteristics of content providers, carriers, and the ever-changing traits and needs of digital media consumers with a focus on emerging technologies on the evolution of interactivity. The course will provide insight into content creation, management, networking, online communities, and content consumption, and the role of evaluation and metrics in understanding the digital landscape. In addition, the course will provide an overview of the social issues facing the digital industry and insights into best practices.

COMM 831: Digital Media Analytics I

3 Credits

This course provides an overview of the methods for collecting, analyzing, and utilizing audience data for digital media. The class will cover the fundamentals of traditional media audience measurement and web metrics, with an emphasis on "first-party" data. Students will learn the methods of data collection, analysis, and use for traditional broadcast media, and the transformation of these practices in the newly digitized and converged multiplatform, multiscreen environment. The course will also cover the basics of data capture for new media and the use of this data for the design of metrics appropriate for various purposes such as monitoring traffic, conversions, and revenue generation. The use of metrics in pricing models for advertising, sales generation, and content distribution will also be covered

Prerequisite: COMM 530, COMM 830**COMM 832: Multimedia Content Development and Delivery**

3 Credits

This course is designed to provide students with a background in the intellectual and practical skills involved with the development, execution, and delivery of strategic messages and content. Students will learn conceptual strategies that lead to the creative process and the resulting message executions that are delivered to targeted audiences on behalf of companies, brands, and organizations through numerous media formats. This course will explore how the role of branded content is evolving in the modern strategic communications landscape and how to apply different types of content generation to new and traditional communications channels. Students will evaluate the pros and cons of numerous modes of content delivery, and will learn the processes and tactics needed to create and implement numerous communication strategies across the major traditional and contemporary media platforms currently used in the industry. Students also will apply the necessary processes and steps to develop an effective multimedia content plan for any client.

Prerequisite: COMM 531 COMM 830

COMM 833: Ethics and Decision Making in Strategic Communications

3 Credits

This course provides a broad exploration of ethical topics in the practices of strategic communications, public relations and advertising. In particular, it investigates transparency, digital ethics, diversity, and mass-communication ethics as they apply to the development and application of communications strategy and content. Students will learn how ethical tenets are examined and incorporated into current theory and research within the fields of general ethical philosophy, public relations, corporate social responsibility, crisis communications, persuasion, and cultural-communication studies. By subsequently applying these principles to industry examples and professional codes of conduct, students will better understand the importance of ethical decision making in the field of strategic communications. Building on insights from the class, students will engage in online discussions and will apply topics learned in the class to identify and analyze contemporary ethical issues and problems affecting the strategic communications industry.

Prerequisite: COMM 830**COMM 834: Strategic Communications Campaigns**

3 Credits

This capstone course requires students to apply the knowledge they have acquired in all the other foundation courses to develop a strategic communications campaign on behalf of a professional client. Students will conduct both primary and secondary research first, and then analyze the competitive environment surrounding the client's service/brand. Based on the research, they will then design the messages, media, and other communication tools as part of a comprehensive communications campaign for the client.

Prerequisite: COMM 530, COMM 531, COMM 830, COMM 831, COMM 832, COMM 833**COMM 835: Social Media Communications**

3 Credits

Social media is profoundly transforming human society in almost every aspect, in particular, communication and business. As social media has become an integral part of human life, it is crucial to understand the underlying mechanisms of social media before making best use of it. A profound knowledge of social media and how to use it productively is not only something "nice to know," but a capability people must have to survive and excel in this new media age. This course focuses on two areas: 1) an in-depth understanding of the social media impact on strategic communications; and 2) how to make best use of social media tools. The impact of social media on cognition, knowledge collaboration, media industry, and strategic communications strategies will be covered. A solid knowledge of social media mechanisms serves as a foundation for making the best use of social media, no matter how current media evolves or what new media platforms emerge in the future.

Prerequisite: COMM 830**COMM 836: Strategic Communications Leadership**

3 Credits

The rise of digital media and the public's demand for transparency in business have elevated the importance of strategic communication. Long gone are the days where communicators were viewed as tacticians

in organizations. Instead, today strategic communicators often hold top positions in companies. This course will provide students with the essential business knowledge they need to navigate as successful communicators. This will include a focus on the business essentials needed such as: terminology, reputation drivers, and leadership roles. It also builds awareness of key stakeholders such as investors, analysts, and communities. Building on these insights, students will be able to conduct communications audits for a company and understand how and why strong communicators are critical to successful companies.

Prerequisite: COMM 830**COMM 837: Reaching Multicultural Populations in Strategic Communications**

3 Credits

There is an increased demand for professional communicators who understand how to reach culturally and ethnically specific market segments using strategic communications strategies. The focus of this course will be on how to effectively and strategically communicate with multicultural populations using mass communication to develop an inclusive environment where diversity is embraced, respected, and valued. The course will explore the economic, political, and social impact of culture and race in our society, socio-economic differences, trends within various multicultural communities and groups, and how traditional and new media communities are reaching these communities. The content of this course will be useful to understand the multicultural market segment. The goal of the course is to understand culture-based communication strategies and market research, multicultural communication research and theories, and apply this understanding to strategic communication decisions.

Prerequisite: COMM 830**COMM 838: Strategic Communications Law**

3 Credits

This course provides a broad exploration of strategic communications law. In particular, it examines how the First Amendment applies to strategic communications, the basic tenets of advertising regulation, privacy issues including the collection and use of personal and geolocation information, intellectual property issues including the use of trademarks and copyrights, and the role of self-regulation in a global communications environment. Students will learn to recognize and anticipate key legal issues that they will face as strategic communications practitioners and how to find answers to relevant legal questions.

Prerequisite: COMM 830**COMM 839: Digital Media Analytics II**

3 Credits

This course will prepare students to demonstrate their competency and ability to navigate the digital media ecosystem and to develop, implement, administer, and evaluate digital marketing campaigns. Toward this end, students will learn to match digital solutions to clients' marketing objectives through critical analysis and understanding of the tools and processes of the industry. Students will differentiate between digital and traditional media by identifying the strengths and weaknesses of each and understanding how digital complements and extends traditional campaigns. Specifically, students will become familiar with

the targeting advantages of digital as related to programmatic buying and re-marketing, as well as behavioral and contextual targeting. Digital advertising formats and platforms will be explored, and students will learn to differentiate between them and to evaluate which formats are best based on client needs and objectives. Digital ad format standards and creative guidelines will be reviewed. Technologies and tools specific to the industry will be summarized, including buy-side and sell-side ad servers, verification systems, and audience segmentation tools. Concepts of statistical analysis will be applied to digital analysis, specifically in the context of A/B testing. Students will apply statistical tests to establish confidence intervals when evaluating alternative marketing approaches and opportunities.

Prerequisite: COMM 530, COMM 830, COMM 831

Communications - CA (COMMS)

COMMS 500: Communications and Cultural Theory

3 Credits

This course is designed to provide students a broad background in communications and cultural theory. COMMS 500 Communications and Cultural Theory (3) This course is an advanced study of various interpretive approaches and methodological tools that are central to the analysis of media artifacts, including newspaper articles, magazines, films, advertising, and television programs. It begins with an overview of various interpretive traditions, including culturalism, psychoanalytic theory, structuralism, ethnic and racial critiques, poststructuralism, postmodernism, feminism, postcolonial studies, and queer theory. It prepares students to critically examine philosophical assumptions regarding the relationship between the nature of knowledge, expression, writing and creative production on one hand, and conceptions of personhood, community, social structures and authority, on the other. Students are required to do significant reading and writing in this course, and to propose and conduct analyses of communication artifacts.

COMMS 503: Research Methods in Communications

3 Credits

This course prepares students to conduct research in communications using both qualitative and quantitative research methods. COMMS 503 Research Methods in Communications (3) This course prepares students to conduct research in communications. It begins with an overview of the different strategies and philosophies of research methodology including scientific method, inference, skepticism, hypothetico-deductive reasoning, critical, humanistic, and naturalistic inquiry. The course focuses on four major types of communications research methodology: experimental, survey, textual analysis and naturalistic inquiry. Students are required to do significant reading and writing in this course, as well as propose and conduct a research project of their own design. This course is a fundamental element of the masters program curriculum in that it prepares students to conduct their thesis projects.

COMMS 519: Communication Technology and Culture in History

3 Credits

An advanced study of various interpretive approaches and methodological tools that are central to the analysis of cultural artifacts. COMMS 519 Communication Technology and Culture in History (3) This course is an advanced study of various theoretical approaches that are central to the analysis of communication technology and

culture in historical context. It begins with an overview of various communication historiographies, including the works of Harold Innis, Walter Ong, Umberto Eco, Elizabeth Eisenstein, James M. Carey, Marshall McLuhan, Lewis Mumford, and others. It engages students in the critical examination of such critical issues as communication and public memory, discourse in historical context and the historical basis of identity. Students are required to do significant reading and writing in this course, and to propose and conduct historical research employing one of the theories discussed in this course.

COMMS 525: Advanced Writer's Seminar

3-9 Credits/Maximum of 9

This course supports the development of advanced writing projects in a range of different genres. COMMS 525 Media Writer's Seminar (3-9 per semester/maximum of 9) This course is an advanced study of narrative styles and research techniques used in various forms of writing, including journalism and creative non-fiction, memoir, opinion pieces, cultural criticism, copy writing, writing for interactive media, and writing for performance media. Offerings in different semesters will focus on different topics in these writing genres. The course prepares students to create original material in a variety of writing genres, and for a variety of media. It is well-suited for the development of creative master's projects, and for extending the student's graduate research into a professional portfolio. The first portion of the course defines the elements of the genre through textual analysis and establishes a theoretical framework. Students will then submit for peer review a project proposal that addresses the appropriateness of the subject to the genre, outlines research methods, defines the intended audience, and provides examples of potential outlets. Students will then submit a first draft for peer review, and finally a finished draft for peer review and evaluation.

COMMS 555: Media Discourse Analysis

3 Credits

This course provides students with advanced theoretical approaches and methodological tools to analyze a variety of media discourses. COMMS 555 Media Discourse Analysis (3) This course provides students with both theoretical approaches and methodological tools to analyze a variety of media discourses. It begins with an overview of linguistic theories, including structuralism, poststructuralism, semiotics, and critical discourse analysis. The course highlights the philosophical relationship between language, culture, identities, politics, and intercultural communications. It also prepares students to examine discourses from multiple angles, such as textually oriented analysis, critical analysis, linguistic analysis, ethnographic analysis, etc. The course then leads into a discussion of several common discursive models in media: ritual, myth, and social drama. It ends with case studies of discourse in films, television, news, advertisement, the Internet, and politics. Students are required to do significant reading and writing in this course, and to propose and conduct a project of discourse analysis of their own design.

COMMS 560: Seminar on Global Culture and Communication

3 Credits

This course explores the globalization of communication and communication technologies within a broad political, economic and cultural context. COMMS 560 Seminar on Global Culture and Communication (3) Developments in technology have led to new levels of interaction and interdependency of human groups and processes

across the boundaries that historically separated them - geography, national identity, state borders, and local community. In such a context, we must re-examine many of our assumptions about space, place, identity, and belonging, and about human social organization and human agency - the potential to purposefully transform ourselves and our surroundings. Globalization calls into question our assumptions about politics, economics, culture, and communication. In this course, students will consider the challenges and opportunities that globalization creates for human community and agency - that is, for the multiple ways in which human activity becomes socially organized and purposeful. They will survey the dominant theories of globalization and regionalization and examine the current trends in regionalization and globalization of politics, culture, communication, economic processes, and regulatory structures. They will focus on the challenges communication globalization poses to past forms of identity, the transformation of traditional understandings of space and place, and the opportunities for new forms of identity, community, and action.

COMMS 568: Media Production Workshop

3-9 Credits/Maximum of 9

This course prepares students for the creation of advanced media projects in traditional and digital media. COMMS 568 Media Production Workshop (3-9 per semester/maximum of 9) This course is a workshop for the creation of advanced media projects in traditional and digital media. Workshop topics will alternate coverage of different media, and will include photography, graphic design, interactive media, video, audio, and other media to reflect the needs of the graduate program. Students will submit proposals that address their project objectives, production plans, and intended audiences. After submitting proposals for peer review and faculty evaluation, students will begin a three-stage process of pre-production, production, and post-production in the creation of their work. This process will require the organization of production elements, the acquisition of media, and the creation of the finished project. This seminar is intended for graduate students who wish to gain experience with new media technologies, pursue creative outlets for their research interests, or develop their professional portfolios. It is an intensive workshop with demanding writing and technology requirements.

COMMS 580: Communications Master's Project

3-6 Credits/Maximum of 6

An original master's paper or creative production with critical paper. COMMS 580 Communications Master's Project (3-6 per semester/maximum of 6) This course may be a scholarly master's paper or it might instead be by a creative production supplemented by a descriptive and analytical paper. The production should display integration in skills and knowledge gained in the program as well as depth within an area of concentration. A committee of Communications faculty, supplemented by outside consultants where appropriate, would be needed to judge the final project.

Prerequisite: COMMS500 ; COMMS503 ; 27 credits towards Master's in Communications

COMMS 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

COMMS 610: Thesis Research

1-15 Credits/Maximum of 999

No description.

Community and Economic Development (CEDEV)

CEDEV 500: Community and Economic Development: Theory and Practice

3 Credits

Understanding theories, concepts, and frameworks of community and economic development and community decision-making models in application to community development practice and issues. CEDEV 500 Principles of Community and Economic Development and Leadership (3) What factors affect the quality of life of American communities? How can citizens and leaders affect change in their community? This course provides an overview of principles of community and economic development and an introduction to approaches to organizing, planning and managing change in communities. Students gain an understanding of principles and strategies of community and economic development in relation to general systems theory, community decision making, and leadership strategies in group and community settings. Students who complete the course should be able to discuss theories and models of development, to apply general systems theory to development issues, and to understand approaches and techniques for community leadership. They will gain an appreciation of conflict and consensus approaches to decision making and change, and understand action strategies for community development and change. This is a required introductory course for all incoming students in the new Community and Economic Development graduate program. The course will also be of interest to graduate students in other programs who have an interest in community and economic development.

CEDEV 505: Leadership Development

3 Credits

Exploration, understanding, and application of leadership roles, strategies, and principles in group and community settings.

Cross-listed with: EDCE 505

CEDEV 509: Population, Land Use, and Municipal Finance

3 Credits

Understanding the interaction of population characteristics, land use, municipal funds, and taxation in a locality and how they impact the operation and management of government jurisdictions. CEDEV 509 Population, Land Use and Municipal Finance (3) How do people approach the task of providing and funding the infrastructure and services in American communities? What effect does different population characteristics and demographic mix have on local governance? Should land use be tied to the changing character of community populations? Where does funding originate for providing municipal goods and services and how do communities manage municipal budgets? This course provides a multidimensional overview of three key aspects of community and economic development. Population - the people. Land Use - the place. Municipal finance - the things they do there. Students will gain an understanding of how to analyze population and demographic issues in communities. They will learn about planning and land use laws,

regulations and issues. They will come to understand the elements and dynamics of municipal finance. The course is designed to integrate the above aspects of community into an overall understanding of key interactions in American communities.

Prerequisite: graduate standing

CEDEV 516: Change in Rural Society

3 Credits

Social change in rural society, emphasizing prediction and control of the change process. Even years. R SOC (CEDEV) 516 Change in Rural Society (3) Rural America has experienced change throughout its history, but the most rapid have occurred in the past three decades. Forces of urbanization, industrialization, technological change and globalization of the economy drive change in rural America, and the effects of these forces differ across the United States. Some rural areas benefit from the changes that occur while others are devastated. Some rural people and places are able to adapt and view change as an opportunity, while others are unable to respond to the forces that threaten them. Individuals, families and communities have changed in response to these broad forces. This becomes manifest in new patterns of inequality, family life, educational attainment, migration, age and racial patterns, health and well-being, and local service availability. Questions examined in this course include: What are the theories that explain or describe the social change that has been affecting rural people and places? What industrial restructuring and economic change has occurred in rural areas, how has it affected rural areas, and what drives this restructuring? What other social change has taken place, and can we determine potential sources of that change? What are the options available to rural people and communities as they adapt to forces of change, and how much can they influence their own futures? Underlying each of these questions is the issue of whether the well-being of rural people, families, and communities has improved or is threatened by these changes, and which rural areas are most likely to benefit and which are threatened. Students will leave the class with a broad understanding of the forces affecting rural America, and how and why those forces influence some people and places differently. Grades are assigned in this class based on a term paper on a topic related to rural social change, reaction papers written about each set of reading assignments, serving as discussion leader, and class participation.

Cross-listed with: RSOC 516

CEDEV 517: International Rural Social Change

3 Credits

Implications of planned change for international rural societies, considering basic structural constraints, known institutional linkages, and potential synergetic consequences. R SOC (CEDEV) 517 International Rural Social Change (3) Three-quarters of the world's population live in developing countries where problems of hunger, malnutrition, underemployment, high morbidity and mortality, overurbanization, and inadequate housing, (to name just a few) often are severe. This seminar covers the sociology of economic change in developing countries. Through an extensive list of readings, a series of topical videos, and in-depth class discussions, seminar participants should come away with a firm grounding in the ways development has been defined, the social and economic problems facing developing countries today, the basic ways in which economic development has been approached theoretically and empirically, the implications for developing countries of being embedded in a larger world economy, the influence of multinational corporations, the

policies that developing countries have followed in fostering economic growth, the nature of foreign aid, the causes and consequences of Third World debt, the nature of the informal economy, rural development and land reform, world hunger and the Green Revolution, and other topics.

Cross-listed with: RSOC 517

CEDEV 533: Rural Development Research Methods and Topics

3 Credits

Advanced theories and methods for rural economic development research.

Prerequisite: ECON 521

Cross-listed with: AEREC 533

CEDEV 550: Principles and Practices of Planning

3 Credits

This course is an overview of the field of planning. It examines the history of planning and the theories behind it, and the corresponding roles that planners can play in their communities. It establishes the legal framework for planning as a profession, and examines landmark legal cases involving planning and its tools. It provides answers for such questions as: Why do communities plan? How has planning developed as a profession? What is the political context of Planning? What is the role of a planner within their community and government structure? How does planning relate to other disciplines? It also examines the different types and levels of planning, the process of planning, what data needs to be collected, how a comprehensive plan is made and implemented, and who planners must interact with in the course of doing their job. Finally, the course reviews contemporary issues in planning. Throughout, the course attempts to emphasize both the positive and negative impacts of planning.

CEDEV 560: Regional Development: Principles, Policy, and Practice

3 Credits

Regional growth and development, focusing on challenges to theory, policy, and practice, emphasizing change in metropolitan, micropolitan, and rural areas. CEDEV 560 Regional Development: Principles, Policy, and Practice (3) Effective regional development requires that history, theory, and policy are reflected in practice. Globalization impacts the development of regions and places in the United States and around the world. In this context, the development of regions impacts and is impacted by the pace and level of development elsewhere. Regional development addresses issues of how growth and disparity are spatially distributed and differentiated, and what causes these patterns to occur. The challenge is twofold. The first challenge is defining exactly what a region is and identifying who ultimately decides the policies and practices that determine its fate. The second is determining who benefits and who bears the costs of particular local and regional development approaches. The purpose of this course is to introduce students to concepts and frameworks of regional development. The first part of the course focuses on definitions and theories of regional growth and development, and begins to uncover ambiguities in pre-existing definitions and theories of regional development associated with topics such as growth and development theory, the new geography, cluster economics, and sustainability. It then delves into various policy approaches and issues including regional, environmental, and rural issues. The course culminates with a discussion of putting regional theory and policy into practice through case studies. Issues and topics

addressed in this course include identifying a region and defining 'place'; understanding the relationship between economic efficiency and sustainability; sustainable development and place-based development; the use of policy and its framing to allow regions and places to build on their assets. Additionally, the course will address how regions become interdependent and how relationships can be optimized in this context, and determining the best way and available sources to garner capital to fund development projects. Students will learn how to identify the assets of a region and the impact of interregional collaboration. The course will provide students with the opportunity to analyze the politics of regional development and the important considerations in regional development planning and practice.

Prerequisite: CEDEV430 and CEDEV500

CEDEV 567: Resilient Communities and Environments

3 Credits

Understanding connections between communities and surrounding ecosystems; exploration of management techniques for building adaptive, resilient, and sustainable communities and environments. CEDEV 567 Resilient Communities and Environments (3) This course provides students with a foundation in concepts which can be used to explore the interconnections of communities and environments, particularly as they apply to community and economic development. The focus of this course is applying concepts from resilience thinking to sustainable community and economic development. In this course, students will explore how communities, whether rural or urban, are linked to their environment, and how this, in turn, can affect the success of community development projects. The class explores the social, political, economic, and ecological barriers guiding these relationships. Topics covered in this context include environmental law and regulation; environmental and land use planning; risk and risk management; the rhetoric of sustainability; natural resource dependency; and interconnections between social and environmental justice. The last portion of the course discusses possible management techniques for building adaptive, resilient, and sustainable communities.

Prerequisite: CEDEV509 and CEDEV452

CEDEV 575: Methods and Techniques for Community and Economic Development

3 Credits

Understanding and applying methods and hands-on experience with techniques used in community and economic development. Lab. CEDEV 575 Methods and Techniques for Community and Economic Development (3) How do I find out what is happening in my community? The economy? The environment? What methods and techniques should I use? I need a toolbox for change! This is a hands-on course designed to provide students with an understanding of community and economic development methods and techniques, and experience in applying them to a variety of problems that they might expect to encounter in the field. The course is based on modules developed and offered by faculty in the Community and Economic Development graduate program. The specific content varies from year to year depending on the needs of each cohort of students. Typical topics include several methods and techniques from each of the following three areas: General Community Assessment Techniques, including identifying power structures, industry structure and employment, natural resources and amenities, human and social capital, local government and services, and land use patterns. Specialized Techniques for Community and Economic Development,

including retail trade area analysis, use of GIS, program evaluation, IMPLAN, Input/Output modeling, location quotient, shift-share analysis, survey design and implementation, and the use of social and economic indicators. Leadership and Process Skills, including visioning, goal setting, and strategic planning; grant writing; small group dynamics; conflict management, negotiation, principled bargaining, and deliberation; public speaking and working with the mass media; coalition building, project management; and use of the Internet, design and implementation of Web pages. This is a required course for all students in the MS in Community and Economic Development.

Prerequisite: graduate standing and approval of the instructor

CEDEV 576: Applications and Practices for Community and Economic Development

1-6 Credits/Maximum of 6

Consideration of community and economic development applications in communities and practices of public and private organizations and agencies.

Prerequisite: graduate standing and approval of the instructor

CEDEV 580: Community and Economic Development Research Application and Practice

3 Credits

Course outlines the steps for students to apply CEDEV theories and methods to a topic in writing their Master's paper.

CEDEV 595: Internship

1-18 Credits/Maximum of 18

Supervised off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

CEDEV 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

CEDEV 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

Community Psychology (CMPSY)

CMPSY 500: Theories and Issues in Community Psychology

3 Credits

Contemporary issues in community psychology will be discussed within the framework of its development from clinical and social psychology.

CMPSY 510: Change Processes

3 Credits

Social change as it takes place within institutions and communities.

CMPSY 511: Social Impacts on Psychological Functioning

3 Credits

Psychological functioning, as it is affected by social contexts.

Prerequisite: CMPSY500 , permission of program**CMPSY 519: Research Methods I**

3 Credits

In-depth examination of research methods utilized by community psychologists and social change activists; course followed by CMPSY 520. CMPSY 519 CMPSY 519 Research Methods I (3) This course, along with CMPSY 520-Research Methods II, will examine the key research methods available to community psychologists and social change activists. The course will emphasize a hands-on experience for students so that they can understand all the components of conducting program assessments. All students will develop pilot projects under the guidance of the instructor that will give the students experience in developing action research/program evaluation questions, completing research literature reviews, developing specific methodologies appropriate to their action research/program evaluation questions, data base design, data analysis, and report writing. There will be a balance between action research, program evaluation, quantitative and qualitative approaches. A final report and presentation of the findings of the pilot project are required. This course is the research methods course required of all community psychology and social change graduate students. This course assumes a basic understanding of introductory statistics and the use of statistical software will be undertaken in the course. The course is the introductory research methods course and will be offered in a sequence with CMPSY 520-Research Methods II. Both CMPSY 519 and CMPSY 520 must be taken in order to complete the Community Psychology and Social Change research methods requirement for graduation. This course is for 3 credits. Faculty: Richard Fiene and Robert Colman

Prerequisite: a C or better in an introductory statistics course within the past two years or a passing grade on the Community Psychology competency examination in introductory statistics; status as graduate student in CMPSY program

CMPSY 520: Research Methods II

3 Credits

In-depth examination of research methods utilized by community psychologists and social change activists. (Continuation of CMPSY 519). CMPSY 520 CMPSY 520 Techniques in Action Research (3) This course is the second of two research methods courses required of all Community Psychology and Social Change graduate students, emphasizing action research, program evaluation, and both qualitative and quantitative measurement. Faculty: Richard Fiene and Robert Colman

Prerequisite: CMPSY519**CMPSY 521: Roles and Methods in Community Psychology**

3 Credits

Advanced course entailing the development of Master's Projects with both fieldwork and research; each student writes a formal proposal.

Prerequisite: permission of program, for degree candidates only.**CMPSY 522: Practicum**

3-6 Credits/Maximum of 6

Fieldwork implementing planned change.

Prerequisite: CMPSY500 , CMPSY510 , CMPSY511 , CMPSY520 , CMPSY521 , for degree candidates only.**CMPSY 594: Research**

3-6 Credits/Maximum of 6

Supervised research on a master's paper.

Prerequisite: for degree candidates only**CMPSY 596: Individual Studies**

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

Comparative and International Education (CIED)

CIED 500: Comparative Education Proseminar I

3 Credits

Methods of comparative education and case studies of governance and administration; first of two part sequence.

CIED 503: Ethnicity, National Identity, and Education

3 Credits

Surveys group-oriented education policies internationally, especially comparing those of Britain, Taiwan, India.

Cross-listed with: EDTHP 507, HIED 503

CIED 504: Perspectives in African Education

3 Credits

Educational systems in selected african countries are examined with respect to colonial history, social, political, and cultural factors.

CIED 508: Globalization and Lifelong Learning

3 Credits

Examination of globalization discourses and their relationships, implications and impacts on lifelong learning processes and contexts. ADTED 508 ADTED (CI ED) 508 Globalization and Lifelong Learning (3) The course is designed to help students to critically examine the nature and impacts of globalization on lifelong learning. The main goal

is to enhance the students' ability to learn and work in a globalizing world and to challenge traditional perspectives about globalization and lifelong learning. As such, the course will adopt a critical perspective on globalization while helping the students to develop a reflective stance on the theory and practice of lifelong learning. A central focus of the course will be to develop a critical analysis that contributes to the building of a more active and socially responsible adult learner. Students will be evaluated using a number of assignments/projects. The major research paper, class presentation, two critiques of theories of lifelong learning, country profile of lifelong and a short reaction paper will count for 90% of the course grade. Class participation will be awarded 10%.

Cross-listed with: ADTED 508

CIED 509: Language, Literacy, Identity, and Culture in a Global Context

3 Credits

Examines the relationship between issues of language, identity and culture for adult learners in an increasingly global context. ADTED 509 ADTED (CI ED) 509 Language, Literacy, Identity, and Culture in a Global Context (3) This core required course provides graduate students in the ADTED Ph.D. program a critical overview of the literature, theories, and scholarship examining the complexities inherent in an increasingly diverse global and post-colonial sphere. Explorations of historical, theoretical, postcolonial perspectives will be the focus, as will the daily portrayals of diverse peoples by the media. Participants in the course will be expected to familiarize themselves with the readings portraying the complexities of ethnicity, indigeneity, race, gender, and social class. Evaluation will focus primarily on writing a scholarly paper, preparing video materials that illustrate the issues, writing their personal educational histories, and participating in class.

Prerequisite: ADTED508

Cross-listed with: ADTED 509

CIED 511: Educational Ethnography: History, Theory, and Methods

3 Credits

This seminar shows students how to use ethnographic methods for education research to inform classroom practice and education policy. The course is centered around the idea that school communities serve as key sites for students of all ages to learn to become members of their culture(s). Course readings include historical to contemporary works of researchers who have shaped educational ethnography. We will also read about education in various settings and discuss anthropological explanations of inequities experienced by minority culture communities or marginalized groups. Students will carry out a mini-ethnographic study based on their area of research interest. The course is especially designed for students to be able to conduct ethnographic studies or make use of ethnographic techniques in future research projects.

Prerequisite: (C I 502; ADTED 550; EDTHP 586;)

Cross-listed with: CI 511

CIED 513: Video Ethnography in Education

3 Credits

Recommended Preparations: A graduate course in educational ethnography This seminar will show students how to use video ethnography in education research. The course is rooted in what is popularly known as the Preschool in Three Cultures method (also known as video-cued multivocal ethnography). We will learn about and watch

films using video-based ethnographic research methods. Students will also carry out mini-video ethnographies in a local classroom.

Prerequisite: C I 502; ADTED 550; EDTHP 586; LDT 574

Cross-listed with: CI 513

CIED 516: Education and Demographic Change

3 Credits

Education is one of the most important factors affecting major demographic shifts and processes worldwide, including the first and second demographic transitions. If, as the old sociological adage goes "demography is destiny," then our destiny is educationally transformed demography. Interdisciplinary research across demography, sociology, neuropsychology, and epidemiology is developing a strong research literature about how the thinking style, behavior, and attitudes of the educated human radically change fundamental dynamics underlying the world's population. The whole way in which we come to our jobs, spouses, and lifestyles; how many children we have and how we raise them; how long we are likely to live, and what will be our eventual demise are all heavily influenced by how much education we have had. The collective force of widespread education and its influence on rising cognitive abilities, scripts for living, and economic well-being are creating a distinctly new type of human population with major benefits and future challenges for a sustainable human population. At the same time, individuals' schooling is also influenced by demographic change. This seminar covers key concepts, theories, and methodological issues related to the intersection of demographical and cultural changes from the education revolution and their impact on subsequent demographic processes.

Cross-listed with: EDTHP 516, SOC 516

CIED 524: Comparative Education Research Using Large-Scale Data

3 Credits

This course is designed to give students an overview of large-scale international assessment databases and to demonstrate how these databases can be utilized to investigate critical issues in education from a comparative perspective. A number of empirical studies using large-scale international assessment databases will be reviewed, and these analyses will be replicated via computer labs. Students will develop a good understanding of large-scale international assessment databases and will learn to apply an appropriate method to address a particular topic of interest. Students will also develop a wide range of research skills necessary to independently conduct comparative research, including but not limited to formulating a research question, conducting a literature review, analyzing empirical data, and interpreting results. Although the focus is mainly on datasets relevant to education and education policy research, the skills taught in the course are broadly transferable to other social sciences including sociology.

Recommended Preparations: Students should have taken either EDTHP 513 and EDTHP 538 or EDTHP 553 as well as EDPSY 505 or SOC 574 before enrolling in this course.

Cross-listed with: EDLDR 524, EDTHP 524, HIED 524

CIED 525: Bakhtin and Education

3 Credits

This seminar gives students an overview of the writings of key members of the "Bakhtin Circle," which included Mikhail Bakhtin, Valentin

Voloshinov, Pavel Medvedev, and others. The core objective of this course is for students to learn about Bakhtinian theory and how to use Bakhtin as a philosophical method in carrying out research studies and analyzing data. In order to do this, we will read the original works of Bakhtin, Voloshinov, Medvedev, and others alongside contemporary educational researchers, theorists, and methodologists who apply Bakhtinian philosophical methods and analyses to the study of education.

Cross-listed with: CI 525

CIED 534: Childhood and Education in Sociological and International Comparative Perspective

3 Credits

The course objective is to use an international comparative lens and sociological perspective to examine the social, cultural, political and economic forces that shape childhood and the role education plays in this process.

Cross-listed with: EDTHP 534, SOC 534

CIED 538: East Asian Education, Leadership, and Reform

3 Credits

The social and organizational characteristics of East Asian schooling, including understandings of authority, power, and leadership, and systemic school reform.

Cross-listed with: EDLDR 538

CIED 540: Youth Participation in Educational Change: Examining Youth Activism, Child Rights, and Youth Voice

3 Credits

Cross-listed with: EDCE 540, EDTHP 540

CIED 541: Contemporary Philosophies of Education

3 Credits

Educational theory and practice in relation to contemporary movements in philosophy. CI ED 541 CI ED (EDTHP) 541 Contemporary Philosophies of Education (3) This graduate seminar explores a range of contemporary philosophies of education viewed from the perspective of different varieties of postmodernism. The study of modern and postmodern western thought is combined with explorations of eastern thought including viewpoints that are emerging today in both the northern and southern hemispheres. While focusing on contemporary educational ideas, it traces their roots in classical and non-modern philosophical sources. This look at the present in terms of the past reveals the paradigm shift presented by contemporary postmodern educational thought. In doing so, considerations for the issues of race, class, gender, ecology, multiculturalism and the regeneration of diverse incommensurable cosmologies, severed or overlooked by some educational philosophers, are explored in their reintegration by contemporary postmodern philosophers of education.

Cross-listed with: EDTHP 541

CIED 542: Issues in Literacy Education

3 Credits/Maximum of 6

Discussion of philosophical, sociological, historical, and curricular issues in literacy education.

Cross-listed with: LLED 542

CIED 543: Comparative and International Trends in Adult Literacy Education

3 Credits

This course critically examines the broad contemporary issues and interdisciplinary trends of literacy education with an international and comparative framework. CI ED (ADTED/AFR) 543 Comparative and International Trends in Adult Literacy Education (3) This course provides a comparative synthesis of what is known about literacy education and adult learning and what it will mean for the 21st century: the context in which literacy takes place; who participates; what they learn and why; the nature of the learning processes; new approaches to adult learning; social media and mobile devices; development theory in adult learning; and other issues relevant to understanding literacy education and adult learning in sociocultural, political, and international contexts. It also examines the newer approaches to adult learning: embodied, spiritual and narrative learning; learning and knowing in non-western perspectives; and cultural theory, poststructural and feminist perspectives. This course investigates questions such as: What does it mean to be literate in the 21st century? Why are teachers experiencing difficulty teaching students skills needed to understand and produce written work? Can schools in the 21st century inundated with digital technologies help students navigate the new literacies? How should adult literacy participants deal with the reality of new media and new literacies? What is the role of non-governmental organizations in this crisis? Overall, this course challenges graduate students to engage other international and non-western frameworks of learning and knowing to think about the purpose of education and learning as well as question the nature of knowledge production itself.

Cross-listed with: ADTED 543, AFR 543

CIED 545: Global Perspectives on Race, Gender, and Lifelong Learning

3 Credits

This course introduces students to some of the major bodies of literature related to race and gender, with a focus on how these intersectional perspectives help to shape our understanding of adult education and lifelong learning. The first part of the course is an overview of several key concepts including global theories of race and gender relevant to diverse societies in distinct geographical locations. The second part of the course explores the intersection of race, gender, and education through the writings of critical feminist scholars. Through this course, students will learn how to analyze race, gender, and class not as independent categories but deeply interconnected spheres of subjective and objective experiences. Students will also learn how theories of race and gender can inform their analyses of adult education policy and practice.

Cross-listed with: ADTED 545

CIED 550: Comparative Education Policy Seminar

3 Credits

Examines the educational policy process world-wide and the influence on schooling of children, youth, and adults in national education systems. CI ED (EDTHP) 550 Comparative Education Policy Seminar (3) In this course students will learn how educational policy is made around the world and what influence this policy has on the schooling of children, youth, and adults in national systems of education. Students will examine recent trends in educational policy that have originated at the international level. Methods of policy research and evaluation will also be examined. The main goal of the course is to give students an understanding of international processes in policy formation and detailed knowledge of current education policy trends worldwide.

Cross-listed with: EDTHP 550

CIED 553: Educational Mobility in Comparative Perspective

3 Credits

Role of education in social mobility, using quantitative, qualitative, and historical methods; focuses comparatively on Britain, East Asia, and South America. CI ED 553/SOC 553/EDTHP 553/CI ED 553. (SOC 553, EDTHP 553, HI ED 553) Educational Mobility in Comparative Perspective (3) Sociologists interested in higher education have attended to the relationships between postsecondary institutions and other institutions, as well as the impact on higher education of general social and demographic processes. Many of the classical ideas in sociological theory, including those of Max Weber and Emile Durkheim, have surfaced in recent debates over the nature of higher education. Sociologists in the U.S. have explored such questions as: the gatekeeping function of higher education; the impact of universities on stratification; and the socializing environment for women and minorities. This seminar introduces some of the classical theorists and contemporary researchers of the sociology of higher education. All seminar participants will be required to write a sample research proposal, based on the readings from the seminar.

Cross-listed with: EDTHP 553, HIED 553, SOC 553

CIED 555: Validity of Assessment Results

3 Credits

Concepts, issues, and methods of validation of educational and psychological assessment including models and approaches to validation, bias, and utility. EDPSY (CI ED) 555 Validity of Assessment Results (3) The goal of this course is to enable the student to acquire a broad perspective on issues and considerations in the process of validating interpretation and uses of tests, scales, assessment procedures, or protocols. Issues of validity are examined from many perspectives including a review of current dominant and alternative validity theories, of known threats to validity, of some advanced specialized statistical techniques; and of test bias, legal issues, psychological/behavioral issues, social/consequential considerations, and philosophical considerations. Additionally, applications are provided through in-depth cross-cultural and historical studies, technical reviews of published commercial tests, and in-depth examinations of controversies.

Prerequisite: EDPSY406 , EDPSY450

Cross-listed with: EDPSY 555

CIED 562: Politics, Language and Pedagogy: Applying Paulo Freire today

3 Credits

Examines the work of Paulo Freire as it applies to community action projects. ADTED 562 / CIED 562 Politics, Languages and Pedagogy: Applying Paulo Freire Today (3) The life and work of Paulo Freire will be the focus of this advanced graduate seminar. Freire was one of the foremost adult educators of our time. Graduate students participating in the course will read and reflect on his vision and how it evolved over time, critiques of Freire, the ways in which his ideas have been applied in diverse geographic and practice settings (e.g., education, community development), and implications for research, policy, and practice. Students will explore how elements related to Freire's work, such as conscientization, transformative action, and pedagogy for liberation, influence pedagogy and community action projects. Readings will include Freire's books, scholarship on Freire, and case studies of Freirean projects, among others.

Cross-listed with: ADTED 562

CIED 564: Social and Cultural Contexts of Learning and Work

3 Credits

Examines the relationship between learning and work with special attention given to how certain forms of learning are legitimized. ADTED 564 Social and Cultural Contexts of Learning and Work (3) This course is designed to provide students with the knowledge and skills required to critically examine the concepts and meanings of learning and work and their relationship to community. The course focuses on formal, nonformal, informal, and incidental learning, with particular emphasis given to how different types of knowledge and different forms of learning are legitimized. The course will allow students to develop and understand the social context in which learning and work operate and how those concepts shape and impact the community. Students will write critiques of readings as well as a major literature review, participate in class discussion, and do a class presentation.

Prerequisite: CI ED500 , ADTED542

Cross-listed with: ADTED 564

CIED 570: Comparative and International Adult Education

3 Credits

Critical and comparative analysis of adult education theory and practice outside North America, including international agency involvement.

Prerequisite: ADTED460

Cross-listed with: ADTED 570

CIED 571: Comparative Higher Education

3 Credits

Comparative methods of studying structural variations in systems of higher education in principal industrialized nations and other selected countries.

Cross-listed with: HIED 571

CIED 581: Social Theory and Lifelong Learning

3 Credits

This course offers an in-depth coverage of social theory, especially as it intersects with research and practice in adult education and lifelong learning. Considering that educational research, educational practice, and the politics of justice in education are informed by specific theoretical frameworks, this course will explore historical and epistemological foundations of theories and engage core modernist theories, postmodern and critical theories, and the theorizing found in Global South discourses.

Cross-listed with: ADTED 581

CIED 582: Reviewing and Editing Education and Policy Journals

3 Credits

Introduction to education policy journals and the review and editing process; discussion of emerging issues within the academic publishing industry.

Cross-listed with: EDLDR 582, EDTHP 582, HIED 582

CIED 587: Curriculum, Culture, and Child Development

3 Credits

Examines human development and cultural factors in planning, designing, and implementing curriculum and instruction in early childhood and childhood education.

Prerequisite: HD FS429

Cross-listed with: ECE 587

CIED 594: Research Topics

1-18 Credits/Maximum of 18

Supervised student activities on research projects identified on an individual or small-group basis.

CIED 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

CIED 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

CIED 845: Intergenerational Programs and Practices

3 Credits

Background, intervention strategies, and issues related to developing intergenerational programs and practices aimed at addressing vital social and community issues.

Cross-listed with: EDCE 845

CIED 897: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject with a professional orientation that may be offered infrequently.

Comparative Literature (CMLIT)

CMLIT 501: Comparative Method in Literary Studies

1-6 Credits/Maximum of 6

Bibliography, research methods, and studies in comparative literature.

CMLIT 502: Comparative Criticism I: Classical to Neoclassical

1-3 Credits/Maximum of 3

Issues in literary criticism from Plato and Aristotle to the mid-eighteenth century.

CMLIT 503: Comparative Criticism II: Romantic to Contemporary

1-3 Credits/Maximum of 3

Principles and theories of literary criticism from eighteenth- and nineteenth- century beginnings to twentieth-century expansion and application.

CMLIT 504: Studies in Literary Genres

3-6 Credits/Maximum of 6

The concept of genre and the evolution of genre theory; application to a specific genre, e.g., the lyric or the novel.

CMLIT 505: Studies in Literary Periods and Movements

3-6 Credits/Maximum of 6

Comparative approaches to cohesive units within literary history, e.g., the Renaissance, the Enlightenment, Romanticism, Surrealism.

CMLIT 506: Studies in Literary Themes and Motifs

3-6 Credits/Maximum of 6

Comparative approaches to recurrent literary themes and motifs; application to a specific example, e.g., literary Utopias or the Faust theme.

CMLIT 507: Comparative Poetics

3 Credits

Theoretical and practical concepts in the comparative, global history of poetry and/or poetics. CMLIT 507 Comparative Poetics (3 per semester/ maximum of 6) This course explores theoretical and practical concepts in the history of poetry and/or poetics. Like all comparative literature courses, it pursues its task through discussions of texts from a wide variety of national or linguistic origins and ranges widely across historical period, medium, and social form, where appropriate. Students will develop a broad array of interpretive skills appropriate to poetry and poetics; they will acquire a knowledge of a wide variety of poetic forms; they will undertake comparative analyses of poems and poetic structures; they will learn how to think about poetics outside poetry.

CMLIT 508: Global Visual Culture

3-6 Credits/Maximum of 6

Comparative study of transnational forms of visual cultural production; e.g. new media, cinema, television, public culture.

CMLIT 509: Comparative Modernisms

3-6 Credits/Maximum of 6

Aesthetic and historical development of Modernism in diverse cultures.

CMLIT 510: Theory and Practice of Translation

3 Credits

Theories of translation and interpretation; importance of translation in literary transmission; application of theoretical concepts to individual translation projects.

Prerequisite: 24 credits in a foreign language

CMLIT 511: Theory and Praxis of Teaching Global Literatures

3 Credits

This course is a professional development seminar that prepares graduate students to contribute professionally to the advancement of teaching global and world literature courses at the college and university level. We will investigate the range of global literatures and consider the term "world literature" in two senses: (a) discerning the theories and meanings inherent in the concept and (b) charting the scope of a world of literature that can fit into one semester within specific institutional expectations. We will discuss the challenges and opportunities inherent in teaching works that are written in a variety of languages, come from a wide range of temporal periods and diverse cultural settings, reflect or provide alternatives to international canons, rely upon varying assumptions and ideologies, and demonstrate different relations to translation, literacy, visuality, orality, and performance. Students will become acquainted with aspects of learning theory and research questions as well as with professional resources such as conferences and journals in this field. We will theorize and explore concrete matters such as teaching within different institutional settings and delivery modes (including online), determining learning objectives and assessment instruments, crafting a syllabus, designing lesson plans, and selecting instructional materials including OER (Open Educational Resources) and other alternatives to expensive textbooks in relation to issues of equity and access. Throughout, we will focus on student learning, on creating an inclusive instructional environment, and on professional ethics as involved in the ways we teach literature. The course is intended to strengthen graduate students' abilities and confidence as teachers now, and their readiness for professional scholarship and for the academic job market later (most faculty jobs in literature are at teaching-focused institutions). We will also consider career diversity: since professional careers other than faculty appointments can often include forms of teaching, aspects of this course may be useful for other career options too.

CMLIT 521: Comparative Seminar in Inter-American Literatures

1-12 Credits/Maximum of 12

Comparative topics presenting literary works of the Americas—North America, South America, and the Caribbean—from early to present times. CMLIT 521 CMLIT 521 Comparative Seminar in Inter-American Literatures

(1-12)This course forms one series of three new-course proposals for seminars in comparative literature with a focus on various parts of the world. While existing seminars focus on comparative studies organized according to concepts such as literary theory, period, theme, or genre, through the proposed new seminars the Department of Comparative Literature seeks to provide visibility for the full complement of courses that reflect the department's global perspective. These proposals also respond to the College's policy to avoid repeated use of the 597 number for similar subject-matter. Thus we are proposing three separate comparative courses on Asian, African, and Inter-American literatures. All represent subject-matter previously taught as CMLIT 597 or other less clearly defined CMLIT numbers. Comparative study of Inter-American literatures is an important part of the curriculum of our Comparative Literature Department. It is a field of study identified as one of our specialties in our recent strategic plans. Joining existing graduate seminars in European literatures, and supplementing proposed seminars in African and Asian literatures, this course and the other two new graduate courses now being proposed will make visible the ways in which the departmental curriculum to covers the diverse geographic areas relevant to comparative literary study. Our department has long taught 100-level and 400-level courses on Inter-American Literature. We believe that we were the first U.S. university to have created such courses some twenty-five years ago. Many of our graduate students possess appropriate languages (such as Spanish, Portuguese, and French) necessary for study in this field. The Americas as two joined continents have produced thousands of writers and a highly diverse literature written in English, Spanish, French, Portuguese, and other languages, including Native American languages. A comparative approach to the study of these literatures provides an appropriately internationalized context for understanding the relations among various literatures of the Americas and for seeing them in the purview of world literature as a whole. In sum, we have long had separate numbers for our undergraduate Inter-American Literature courses and we have previously offered graduate Inter-American courses under general numbers. In addition to complying with College policy and not continuing to use 597 repeatedly, we wish to make this field more visible within our curriculum by giving it a course number of its own.

CMLIT 522: Comparative Seminar in Asian Literatures

1-12 Credits/Maximum of 12

Comparative topics presenting literary works of Asia, from the origins of literature in Asia to the present time. CMLIT 522 CMLIT 522 Comparative Seminar in Asian Literatures (1-12)This course forms one of a series of three new-course proposals for seminars in comparative literature with a focus on various parts of the world. While existing seminars focus on comparative studies organized according to concepts such as literary theory, period, theme, or genre, through the proposed new seminars the Department of Comparative Literature seeks to provide visibility for the full complement of courses that reflect the department's global perspective. These proposals also respond to the College's policy to avoid repeated use of the 597 number for similar subject-matter. Thus we are proposing three separate comparative courses on Asian, African, and Inter-American literatures. All represent subject-matter previously taught as CMLIT 597 or other less clearly defined CMLIT numbers. Comparative study of Asian literatures is an important part of the curriculum of our Comparative Literature Department. It is a field of study identified as one of our specialties in our recent strategic plans. Joining existing graduate seminars in European literatures, this course and the other two new graduate courses now being proposed will make visible the ways in which the departmental curriculum to covers the diverse geographic areas relevant to comparative literary study. Our Department offers

instruction in three Asian languages (Chinese, Japanese, and Korean), has long taught 100- and 400-level courses in Asian literatures (Comp Lit 004 and Comp Lit 404), has linkages with universities in China and Japan, and has attracted a steady stream of graduate students who work in Asian literatures and languages. Interest in the literatures of Asia is strong. As a further indication of our Department's globalization, we are establishing a new undergraduate major in Japanese (this proposal is presently in the Senate). In sum, we have long had separate numbers for our undergraduate Asian language and literature courses and we have previously offered graduate Asian literature courses under general numbers. In addition to complying with College policy and not continuing to use 597 repeatedly, we wish to make this field more visible within our curriculum by giving it a course number of its own.

CMLIT 523: Comparative Seminar in African Literatures

1-12 Credits/Maximum of 12

Comparative topics presenting literary works of Africa, from the origins of literature in Africa to the present time. CMLIT 523 Comparative Seminar in African Literature (1-12) This course forms one of a series of three new-course proposals for seminars in comparative literature with a focus on various parts of the world. While existing seminars focus on comparative studies organized according to concepts such as literary theory, period, theme, or genre, through the proposed new seminars the Department of Comparative Literature seeks to provide visibility for the full complement of courses that reflect the department's global perspective. These proposals also respond to the College's policy to avoid repeated use of the 597 number for similar subject-matter. Thus we are proposing three separate comparative courses on Asian, African, and Inter-American literatures. All represent subject-matter previously taught as CMLIT 597 or other less clearly defined CMLIT numbers. Comparative study of African literatures is an increasingly important part of the curriculum of our Comparative Literature Department. It is a field of study identified as one of our specialties in our recent strategic plans. Joining existing graduate seminars in European literatures, this course and the other two new graduate courses now being proposed (on Asian and Inter-American literatures) will make visible the ways in which the departmental curriculum covers the diverse geographical areas relevant to comparative literary study. Our Department offers language instruction in Swahili and Arabic, has long taught 100-level and 400-level courses on African literature, has developed linkages with several African universities, and has attracted a steady stream of graduate students to work in African literature during the last two decades. Interest in the literatures of Africa is strong. Africa as a continent has produced thousands of writers and a highly diverse body of literature written in English, French, Arabic, Portuguese and over 50 African languages. It is also a rich source of literature recorded from oral traditions maintained in the more than 1,000 languages spoken on the continent. A comparative approach to the study of these literatures provides an appropriately internationalized context for understanding African literatures and for seeing them in the purview of world literature as a whole. In sum, we have long had separate numbers for our undergraduate African languages and literature courses and we have previously offered graduate courses on African literatures under general numbers. In addition to complying with College policy and not continuing to use 597 repeatedly, we wish to make this field more visible within our curriculum by giving it a course number of its own.

CMLIT 524: Comparative Arab/ic Literature and Criticism

3 Credits

This course provides students with a comprehensive overview of modern Arab/ic literature, in dialogue with critical approaches that illuminate these texts within a comparative framework. By examining the critical interventions and debates that have shaped Arabic literature up until our present moment, this course invites students to attend to the manifold ways that this literature engages the major theoretical paradigms of global literary studies. It subsequently de-provincializes these debates beyond the limited purview of ethno-linguistic, philological, or geopolitical divisions of the field. It instead situates this literature as an active agent within world literary debates and criticism, both past and present. In this regard, the course will invite students to critically reframe the (neo)colonial or (neo)orientalist categories of the 'Middle East' and 'Near East'; and to consider other supra- and transnational exchanges staged across Asia, Africa, and the Mediterranean, as well as in the diaspora. In so doing, the course aims to look beyond the exclusive lens of the (post)colonial, or binary models of center/periphery, that dominate discussions of 'third-world' literature. In moving away from the siloing of these traditions within Area Studies, the course considers the repercussions of these debates for narrative, aesthetic, geopolitical, theoretical, and pedagogical concerns across the study of Comparative Literature. Students will read a wide variety of literary texts in English translation, spanning a range of genres (prose, poetry, drama, film). Alongside these works, they will engage with critical and philosophical writings from the Arab/ic context, on topics such as aesthetics and the sublime, affects and embodiment, futurity and dystopia, ecocriticism and the Anthropocene, language, modernity/postmodernism, globalization, trauma, and more. After having taken this class, students will have gained a sound grasp of the field, as well as its literary and historical dimensions. They will also have developed a critical understanding of the current challenges and directions of the study of modern Arab/ic literature.

CMLIT 526: Global Japanese Literature

3 Credits

This course provides students with a comprehensive overview of global Japanese literature, in dialogue with critical approaches that illuminate these texts. The narrative of ethnic, geographic, and linguistic isomorphism & the notion that a Japanese people speaking a Japanese language live in the Japanese islands & is a carefully crafted and relatively modern fiction in Japan. This course examines the gradual, and still contentious, formation of a "Japanese" literary canon from multiple vantage points. The class combines a survey of key texts composed in the Japanese islands and in Japanese diaspora communities, alongside an examination of the critical paradigms that surround the production, reception, and interpretation of these texts.

CMLIT 532: Critical Studies in Global Korean Literature and Culture

3-6 Credits

This course provides students and overview of key texts and trends in modern Korean literature and culture from a global perspective. It examines the most prominent literary and visual works that articulate the intricacy of modern Korean culture at the intersections of major historical, ideological, and environmental forces and issues in the twentieth century such as colonialism, cultural imperialism, Cold War politics, democratic movement, feminist movement, environmental injustice, etc. Students will also read texts on modern Korean history

as well as literary and cultural criticism and theories to improve their analytical ability that will be demonstrated in their writings.

Recommended Preparation: Students are expected to read in the original when they are capable. However, in anticipation of a broad array of language abilities in the classroom, materials will also be made available in English translation.

Cross-listed with: ASIA 532

CMLIT 543: Literary Relations

3-6 Credits/Maximum of 6

Mutual influences among specific literatures and cultures; for example, German-American, French-American, Inter-American, or East-West literary relations.

CMLIT 570: Forces in Contemporary Literature

3-6 Credits/Maximum of 6

Intellectual currents and experimental forms in contemporary world literature.

CMLIT 577: Critical Perspectives on Modern Chinese Literature

3 Credits

This course provides students with an overview of the core texts and main critical paradigms of modern Chinese literary studies. This course provides students with a comprehensive overview of the main critical approaches to modern Chinese literature, by placing these paradigms into historical perspective and linking them with key texts that illuminate the authors' arguments and demonstrate exemplary readings that have proven influential in the field, past and present. The particular focus of the course may vary according to the instructor (e.g. themes, genres, regions etc.), but the course will generally cover critical interventions and debates, helping students to understand the emergence of the field in its present form; they will also scrutinize major trends that are providing new directions for the study of modern Chinese literature. In addition to the critical literature, students will read a range of key literary texts, from the late Qing to the twenty-first century, that provide insights into the forces (aesthetic and intellectual, as well as social and historical) that have shaped the canon of modern Chinese literature. Critical analyses and literary texts are chosen in a way so as to illuminate each other. At the end of the class, students will have gained a sound grasp of the field and its literary and historical dimensions, and develop a critical understanding of the current challenges and directions of the study of modern Chinese literature. Cross Listings: CMLIT 577 will be added as a cross-listed course.

Cross-listed with: ASIA 577

CMLIT 580: Contemporary Literary Theory

3 Credits

Major issues in contemporary literary theory and their significance for criticism, with emphasis on continental European theorists and their influence.

CMLIT 589: Technology in Foreign Language Education: An Overview

3 Credits

Approaches to the uses and research applications of multimedia and other educational technologies applied to the teaching of foreign languages. (also crosslisted with SPAN 589)

Cross-listed with: APLNG 589, FR 589, GER 589, SPAN 589

CMLIT 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

CMLIT 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

CMLIT 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

CMLIT 601: Ph.D. Dissertation Full Time

0 Credits/Maximum of 999

No description.

CMLIT 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 3

Supervision of teaching; consideration of instructional aims and objectives, methods of lecturing and leading discussions, evaluation of student work.

CMLIT 603: Foreign Academic Experience

1-12 Credits/Maximum of 12

Foreign study and/or research constituting progress toward the degree at a foreign university.

CMLIT 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

Comparative Medicine - MD (CMED)

CMED 501: Biology and Care of Laboratory Animals

3 Credits

Presentation of the anatomic and physiologic characteristics of the commonly used laboratory animal species and their relation to biomedical research.

CMED 503: Laboratory Animal Genetics

3 Credits

Genetic principles applied to laboratory animals used for investigations of diseases that may be controlled or influenced by genetic factors.

CMED 507: Techniques of Laboratory Animal Experimentation

3 Credits

Techniques of drug administration, infusion, and collection of body fluids and materials; gnotobiology; use of radioisotopes and bioinstrumentation.

CMED 515: Experimental Surgery of Laboratory Animals

3 Credits

Surgical techniques, including nephrectomy and Goldblatt clamp, bladder and gastric pouches, bile duct cannulation, intraventricular operation, cardiac and cerebrovascular catheterization.

CMED 530: Diseases of Laboratory Animals I

3 Credits

Physiological and pathological expressions of both infectious and metabolic- degenerative diseases of rodents, with emphasis on diagnostic and control methods.

CMED 531: Diseases of Laboratory Animals II

3 Credits

Physiological and pathological expressions of both infectious and metabolic- degenerative diseases of nonhuman primates and other species of animals.

CMED 535: Comparative Pathology

3 Credits

Comparative pathologic characteristics of infectious and metabolic diseases of animals and man.

CMED 590A: Colloquium

1-3 Credits/Maximum of 9

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

CMED 590B: Contemporary Topics in Laboratory Animal Science Colloquium

1-3 Credits/Maximum of 3

Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers. This colloquium is specifically focused on recent literature in the field of Laboratory Animal Medicine.

CMED 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

CMED 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

CMED 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

CMED 801: Foundations in Laboratory Animal Welfare Laws, Regulations, and Guidelines I

1 Credits

This course uses a problem-based learning approach to develop the ability to interpret and apply laws and regulations that pertain to the humane care and use of laboratory animals. In particular, students will learn how to critically evaluate an Institutional Animal Care and Use Committee (IACUC) protocol for compliance with laws, regulations, guidelines and position statements that pertain to laboratory animal care and use. Licensed veterinarians enrolled in the Laboratory Animal Medicine Master's degree training program are the target audience

Recommended Preparation: Previous experience in basic science research using animals, and/or familiarity with regulations that govern animal care and use would provide good preparation for this course.

CMED 810: Management of Animal Care and Use Programs in Biomedical Research

1 Credits

This course will provide opportunities for students to apply knowledge and skills needed for administration and management of an animal resources program in biomedical research. Using active learning practices, students will explore topics specific to housing and caring for research animals. Topics include animal facility design, disaster planning, personnel management, waste management, fiscal management, process management concepts (LEAN, Six Sigma, Systems Approaches), and strategic planning.

Computer Science (CMPSC)

CMPSC 598: Special Topics

1-9 Credits/Maximum of 9

Formal courses given infrequently to explore, in depth, a comparatively narrow subject that may be topical or of special interest; several different topics may be taught in one year or semester.

Computer Science - CA (COMP)

COMP 505: Theory of Computation

3 Credits

Topics in discrete mathematics, discrete probability, first order logic and models of computation.

Prerequisite: CMPSC463

COMP 511: Design and Analysis of Algorithms

3 Credits

Amortized analysis, graph algorithms, NP-complete problems, approximation algorithms, parallel algorithms.

Prerequisite: CMPSC463

COMP 512: Advanced Operating Systems

3 Credits

A study of the principles and practice of distributed system design, including communication, synchronization, processes, file systems, and memory management.

Prerequisite: CMPSC472

COMP 513: Formal Methods for Software Engineering

3 Credits

Object-oriented software development, formal specification techniques and related CASE tools, software re-use, verification and validation, transformational development.

Prerequisite: CMPSC487W , COMP 511 , or permission of the program

COMP 516: Advanced Programming Languages

3 Credits

Programming paradigms and styles, object-oriented programming, formal semantics, programming language design.

Prerequisite: CMPSC460

COMP 517: Computer Security

3 Credits

Introduction to the area of computer security and current issues associated with computer security.

Prerequisite: MATH 315

COMP 519: Advanced Topics in Database Management Systems

3 Credits

Concurrency control, crash recovery, query processing, semantic data models, advanced file access, distributed database systems, performance, case studies, advanced applications.

Prerequisite: CMPSC430 , MATH 315

COMP 520: Artificial Intelligence

3 Credits

Problem solving, knowledge representation, language understanding, perception, learning, artificial neural networks.

Prerequisite: CMPSC463

COMP 524: Evolutionary Computation

3 Credits

Topics in evolutionary algorithms and genetic algorithms.

Prerequisite: COMP 511 or permission of the program

COMP 545: Computer Architecture

3 Credits

Cache, pipelining, memory design, interconnection networks, multiprocessor systems.

Prerequisite: CMPSC312

COMP 594: Master's Studies

3 Credits/Maximum of 3

Presentation of various research techniques, in-depth study of a specific computer science problem, development of a written paper or project, and an oral defense.

Prerequisite: A minimum of 2 of the 500-level computer science required courses or permission of the program.

COMP 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

COMP 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

COMP 600: Thesis Research

1-15 Credits/Maximum of 999

Research into a specific computer science problem, development of a scholarly written paper, and an oral defense.

Prerequisite: A minimum of 2 of the 500-level computer science required courses or permission of the program.

Computer Science and Engineering (CSE)

CSE 511: Operating Systems Design

3 Credits

Concurrent programming; design of I/O subsystem, memory management, and user interface; kernel design; deadlocks, protection and security; case studies.

Prerequisite: CMPSC473

CSE 513: Distributed Systems

3 Credits

Protocol hierarchies; routing and flow control algorithms; distributed operating systems; communication and synchronization mechanisms; resource allocation problems.

Prerequisite: CSE 411**CSE 514: Computer Networks**

3 Credits

Network subsystems, ARPANET, SNA, DECNET, network protocols (physical databank, network, transport, sessions, presentation, application), routing and congestion control, network optimization. CSE 514 CSE 514 Computer Networks (3) This course discusses the characteristics and low-level protocols of computer networks. It provides basic background, design, and evaluation skills in telecommunication and communication networks. The course will cover International Standards Organization Open System Interconnection (ISO-OSI) reference model, design issues and protocols in the data link layer, network layer and transport layer; architectures and control algorithms of local-area networks, and point-to-point networks; standards in network access protocols; models of network interconnection; and overview of networking and communication software. The course will emphasize on Internet standards such as TCP/IP and many advanced topics in networking. Students should already have some network background before taking this course. Students should also have necessary analytical and programming skills to do networking projects.

Prerequisite: CMPEN362 ; E E 353 or E E 350**CSE 515: Reliable Data Communications**

3 Credits

Discussion of problems and solutions for ensuring reliable and efficient communication over wired and wireless links and data networks.

Prerequisite: Communication Networks; STAT 418

Cross-listed with: EE 565

CSE 516: Mobile Networking

3 Credits

This course explores the fundamental concepts, algorithms, and engineering processes of analyzing mobile telecommunication voice and data networks and provides simple analytical tools for designing and evaluating these networks. The course is divided into three parts. First, the architecture and algorithms for mobility management and service control in cellular networks is presented. Using simple queuing models, students analyze the performance of these networks and examine design trade-offs. The latest generation network (5G, etc.) is used as a case study. Second, the architecture (radio access and core network) and algorithms for mobility management in packet-based mobile telecommunications networks is presented. Finally, protocols, algorithms, and performance consideration for the mobile Internet are presented. This course focuses on the practical applications of these concepts, using real systems to illustrate architecture and protocol trade-offs. The course provides students with a venue in which to pursue research in mobile networking that complements several core areas of the graduate CSE curriculum (e.g., networks, architectures, algorithms, and formal analysis). Following the course in networking, this course

enables students to learn the skills and obtain the background knowledge necessary to generate publishable research in the area of mobile networks. This course will serve as an elective for students interested in mobile networking and telecommunications.

CSE 517: Performance Evaluation

3 Credits

Tools and techniques for PE, Analytical and Simulation models, evaluation of multiprocessors, multicomputer and LANs, scheduling policies, case studies.

CSE 521: Compiler Construction

3 Credits

Design and implementation of compilers.

CSE 522: Program Analysis

3 Credits

This course explores the fundamental concepts, algorithms, and engineering processes of analyzing programs for correctness, security, and performance. It is intended as a course for first-year or second-year graduate students in computational majors such as computer science and computer engineering since it covers how to analyze programs rigorously based on program semantics. First, the course will cover basic static analysis algorithms, from dataflow analysis to complex points-to analysis. This part will also cover logical programming and ask students to implement static-analysis algorithms using logical programming. The next part will give an overview of the theory of static analysis, using the framework of abstract interpretation. The third part will focus on dynamic analysis and its instances such as taint tracking. The final part will discuss one application of static analysis in analyzing binary code for security. Upon successful completion of the course students will be able to demonstrate understanding of and implement the basic program analysis algorithms and be able to customize these algorithms for specific applications.

Prerequisites: CMPSC 461 or CMPSC 464**CSE 523: Programming Languages**

3 Credits

This course explores advanced concepts of programming languages and how the concepts are applied to language-based security. The course first covers programming language theory, including program semantics, Induction, lambda calculus. Then, the course covers language-based techniques, such as type system and program verification, that can provably rule out incorrect/insecure programs. Finally, the course engages the students with hands-on projects to apply the techniques to solve security problems, such as analyzing information flow leakage in programs and automatic code rewriting to avoid side channel attacks. Upon completion of the course, students will demonstrate understanding of advanced programming language concepts and be ready to apply them for specific applications.

CSE 530: Fundamentals of Computer Architecture

3 Credits

Advances in computer architecture, Pipelining, parallelism, and multiprocessing.

Prerequisite: CMPEN431

CSE 531: Parallel Processors and Processing

3 Credits

Parallel processor organization; basic algorithms suitable for such systems; parallel sorting and interconnection networks; applications and discussion of specific processors.

Prerequisite: CSE 530

CSE 532: Multiprocessor Architecture

3 Credits

Fundamental structures of multiprocessors; interprocess communications, system deadlocks and protection, scheduling strategies, and parallel algorithms; example multiprocessor systems.

Prerequisite: CSE 530

CSE 536: Fault Tolerant Systems

3 Credits

Attributes of fault-tolerant systems and their definitions; reliability and availability techniques; maintainability and testing techniques; practice of reliable system design.

Prerequisite: CSE 530

CSE 539: Topics in Computer Architecture

3 Credits

Study of current advanced issues in design, implementation and applications of complex computer systems.

Prerequisite: CSE 530

CSE 541: Database Systems I

3 Credits

Data models and relational database design; database integrity and concurrency control; distributed database design and concurrency control; query optimization.

Prerequisite: CMPSC431W

CSE 543: Computer Security

3 Credits

Specification and design of secure systems; security models, architectural issues, verification and validation, and applications in secure database management systems.

Prerequisite: CMPSC461

CSE 544: System Security

3 Credits

Review current research in computer and operating system security. CSE 544 System Security (3) This course is built around the problem of authorization (access control). After a discussion of threats of systems security, we will examine the fundamental mechanism for access control, the reference monitor. We will define the principle of the reference monitor and review how it is used to implement access control. The second major topic is mandatory access control (MAC). We will examine the implementation of MAC in Linux via the Linux Security Modules (LSM) framework. This part of the class relies heavily on a case study of the SELinux system to illustrate how MAC can be implemented and how security goals can be enforced by using MAC. The third major topic focuses on how network security functions are implemented in the operating system. Such functions include authentication, firewalls, and secure communication via IPsec. The implementations of such functions in the Linux operating system will be the focus of this particular section of the course. The third major topic examines system security architectures for distributed systems. The main foci are mechanisms based on public key systems, such as trust management, integrity measurement, and web-based operating systems. We will investigate research results in these areas and hypothesize where this emerging space may evolve. The fourth major topic focuses on lower level features of operating systems and their impact on security. We will first review virtual machine systems and recent research results that indicate an emergence of virtual machine mechanisms as a practical basis for achieving strong systems security guarantees. We will then explore work on protecting access to data on systems that is resident in traditional (file systems) and unexpected (other temporary) storage locations. The final two sections, Special Topics and Wrap-Up, will cover a number of areas of importance to system security, but not really falling into the traditional system areas. This includes emerging topics such as language-based security, the use of source code analysis for achieving system security goals, host intrusion detection, and emerging areas of recent interest. These topics will change over time as interests and technology develop. We will conclude with a discussion of the major challenges and state of system security, and make predictions about the future of system security.

Prerequisite: CSE 458 , CSE 411 , CSE 543

CSE 545: Network Security

3 Credits

Advanced methods and technologies for network security. CSE 545 Network Security (3) CSE 545 covers the major topics and emerging trends in network security. We begin with a discussion of the basic problems, architectures and devices in current and next generation networks. This will include a discussion of how these topics relate to popular articles and the press. This part of the class relies heavily on case studies to illustrate how security impacts the social and technical aspects of the Internet and computing systems. The second major topic focuses on the use of applied cryptography supporting network protocols. This will provide a deeper view of the basics of cryptographic constructions and consider formal methods for proving their correctness. The realities and limitations of the current use of cryptography will be considered. Students will spend a considerable amount of time developing and analyzing their own security protocols. The third section of this course will focus on the management and vulnerabilities of current network environments. This will begin with a discussion of emerging

authentication systems (federated authentication, graphical passwords, biometrics), and then turn to the security problems of large-scale network management. The class will then review major thrusts in network security: the management and vulnerabilities of wireless systems. The course concludes with a discussion of topical areas in network security. This is the most flexible part of the class, and will reflect the needs and desires of the instructors and students on a semester-to-semester basis.

Prerequisite: CSE 543

CSE 546: Cryptography

3 Credits

Introduction to the theory and techniques of modern cryptography, with emphasis on rigorous analysis and mathematical foundations. CSE 546 Cryptography (3) This course provides an introduction to the theory and techniques of modern cryptography. The course begins by reviewing relevant mathematical tools and moves on to develop definitions and examples of secure protocols for important cryptographic tasks such as symmetric- and private-key encryption, authentication, and digital signatures. Students will be evaluated primarily on weekly problem sets designed to verify and improve their understanding of the materials. Grades will be based on problem sets, a mid-semester examination, a final examination, and class participation/lecture notes. With regard to "lecture notes," students (in teams) must prepare a written summary of one lecture during the course. The goal of this exercise is to practice technical writing and exposition. This course will serve as an elective for graduate students in Computer Science & Engineering and the Post-Baccalaureate Credit Certificate Program in Computer & Network Security (under development).

Prerequisite: CSE 465

CSE 547: Wireless and Mobile Security

3 Credits

While wireless communications and mobile applications have made our daily life much easier, they also bring to us various security and privacy threats that did not exist in the wired networks. This course explores the latest research literature in security and privacy of emergent wireless and mobile systems including sensor networks, smartphones, cellular networks, Internet of Things (IoT), drones, autonomous driving, and wearable devices. Students will learn the theoretical framework, analytical skills and research methodology and tools in the this field, and synthesize their knowledge to formulate security models, design security protocols, apply principled security analysis techniques for network and software flaws, and malware detection, evaluate the security and privacy threats of various mobile systems as well as the challenges and design solutions for addressing them. Research papers on these topics in recent computer-science conferences and journals will be included for reading and discussion.

Prerequisite: CMPSC 443 or CSE 543

CSE 550: Numerical Linear Algebra

3 Credits

Solution of linear systems, sparse matrix techniques, linear least squares, singular value decomposition, numerical computation of eigenvalues and eigenvectors.

Prerequisite: MATH 441 or MATH 456

Cross-listed with: MATH 550

CSE 551: Numerical Solution of Ordinary Differential Equations

3 Credits

Methods for initial value and boundary value problems; convergence and stability analysis, automatic error control, stiff systems, boundary value problems.

Prerequisite: MATH 451 or MATH 456

Cross-listed with: MATH 551

CSE 552: Numerical Solution Of Partial Differential Equations

3 Credits

Finite difference methods for elliptic, parabolic, and hyperbolic differential equations; solutions techniques for discretized systems; finite element methods for elliptic problems.

Prerequisite: MATH 402 or MATH 404 ; MATH 451 or MATH 456

Cross-listed with: MATH 552

CSE 554: Error Correcting Codes for Computers and Communication

3 Credits

Block, cyclic, and convolutional codes. Circuits and algorithms for decoding. Application to reliable communication and fault-tolerant computing.

Prerequisite: Communication Networks

Cross-listed with: EE 564

CSE 555: Numerical Optimization Techniques

3 Credits

Unconstrained and constrained optimization methods, linear and quadratic programming, software issues, ellipsoid and Karmarkar's algorithm, global optimization, parallelism in optimization.

Prerequisite: CMPSC456

Cross-listed with: MATH 555

CSE 556: Finite Element Methods

3 Credits

Sobolev spaces, variational formulations of boundary value problems; piecewise polynomial approximation theory, convergence and stability, special methods and applications.

Prerequisite: MATH 502 , MATH 552

Cross-listed with: MATH 556

CSE 557: Concurrent Matrix Computation

3 Credits

This course discusses matrix computations on architectures that exploit concurrency. It will draw upon recent research in the field.

Prerequisite: CMPSC451 , CMPSC455 , CMPSC450 , MATH 451 , or MATH 455

CSE 559: Wireless and Mobile Sensing in the Age of IoT

3 Credits

This course covers state-of-the-art research on Internet of Things (IoT), with a focus on wireless networking and mobile sensing. Topics of discussion include high precision localization, GPS, smart healthcare, autonomous vehicles and drones, Augmented/Virtual Reality, Battery free communication, 5G basics, Security etc. The course begins with a basic background in linear algebra, signal processing, wireless communications in the context of applications. Thereafter, the topics will be organized into various applications and research from top notch conferences will be presented. In addition, within each application, the appropriate background and common principles underlying Bayesian Filtering, Maximum Likelihood, Sensor design basics etc will be emphasized.

Recommended Preparations: Programming skills are required. Ability to program in any programming language is fine.

Cross-listed with: EE 559

CSE 561: Data Mining Driven Design

3 Credits

The study and application of data mining/machine learning (DM/ML) techniques in multidisciplinary design. CSE 561 / EDSGN 561 / IE 561 / IST 561 Data Mining Driven Design (3) This course examines how theoretical data mining/machine learning (DM/ML) algorithms can be employed to solve large-scale, complex design problems. Knowledge Discovery in Databases (KDD) is the umbrella term used to describe the sequential steps involved in capturing and discovering hidden, previously unknown knowledge in large databases. The course begins with foundational information regarding engineering design and provides an overview of KDD and the emergence of the digital age. Students will investigate data acquisition and storage techniques where they will learn the difference between stated and revealed data as related to design. Students will construct their own databases and learn essential techniques in data base queries (SQL) and management. Data transformation techniques, such as binning and dimensionality reduction, will be examined in the data transformation section of the course. This course has a design-driven focus, which will enable students to solve real-life design challenges spanning diverse domains. Students will work on project-based exercises aimed at proposing novel data mining algorithms, or employing existing algorithms to solve design problems in fields relating to engineering, healthcare, financial markets, military systems, to name a few. Data visualization techniques will also be studied to help communicate complex data mining models in a timely and efficient manner.

Cross-listed with: EDSGN 561, IE 561, IST 561

CSE 562: Probabilistic Algorithms

3 Credits

Design and analysis of probabilistic algorithms, reliability problems, probabilistic complexity classes, lower bounds.

Prerequisite: CSE 565

CSE 564: Complexity of Combinatorial Problems

3 Credits

NP-completeness theory; approximation and heuristic techniques; discrete scheduling; additional complexity classes.

Prerequisite: CSE 565

CSE 565: Algorithm Design and Analysis

3 Credits

An introduction to algorithmic design and analysis.

Prerequisite: CMPSC465; Concurrent: CMPSC464

CSE 566: Algorithms and Data Structures in Bioinformatics

3 Credits

This course covers elegant algorithmic and data structure techniques that underpin modern biological data analysis. Bioinformatics is a growing field with immediate implications for our understanding of biology and treatment of disease. This course covers elegant algorithmic and data structure techniques and their use in bioinformatics. The emphasis is on recurrent ideas that underpin modern biological data analysis, presented in conjunction with their biological applications. The course is suitable both for students interested in doing bioinformatics research and those interested in applications of algorithms to the natural sciences. Some of the algorithms/data-structures that may be covered include exact string matching, suffix trees, suffix arrays, de Bruijn graphs, hidden Markov models, breakpoint graphs, succinct data structures, the Burrows-Wheeler transform, the FM-index, network flow, and bidirected graphs. Some of the biological applications will include sequence alignment and assembly, cancer genomics, phylogeny, gene finding, and variation detection. No prior biological or bioinformatics knowledge is required. A basic understanding of data structures and algorithms (equivalent to CMPSC465) is a prerequisite; however, exceptionally motivated students can contact the instructor to discuss their options. This course is complementary to existing bioinformatics courses offered through other programs on campus. These courses may be taken concurrently but are not prerequisites. Prerequisites: CMPSC465 Cross Listings: BMMB 566 will be added as a cross-listed course.

Prerequisite: CMPSC465

Cross-listed with: BMMB 566

CSE 575: Architecture of Arithmetic Processors

3 Credits

Algorithms and techniques for designing arithmetic processors; conventional algorithms and processor design; high-speed algorithms and resulting architectural structures.

Prerequisite: CMPEN411

CSE 577: VLSI Systems Design

3 Credits

Engineering design of large-scale integrated circuits, systems, and applications; study of advanced design techniques, architectures, and CAD methodologies.

Prerequisite: CMPEN411

CSE 578: VLSI Computer-Aided Design Tools

3 Credits

VLSI circuit design tools: placement, routing, extraction, design rule checking, graphic editors, simulation, verification, minimization, silicon compilation, test pattern generation.

Prerequisite: CMPEN411

CSE 582: Natural Language Processing

3 Credits

The question addressed by the field of natural language processing (NLP), or computational linguistics, is how to get computers to process human language in a useful manner, such as to extract information from text, to generate text from semantic representations, or to support human-machine interaction through language. This overview course presents natural language processing in two ways. From one perspective, it is an applied computational discipline, where the main goal is to turn language data into computable data. This makes it possible to build many applications where human language is processed, and to invent new applications. NLP is also a theoretical discipline that addresses problems in how to identify the units and structures of language, such as how to specify the vocabulary of a language, how to describe the allowable combinations of words, how to represent the meanings of words and phrases, and how to get at the implicit intentions of language users. The class covers both aspects of NLP.

CSE 583: Pattern Recognition and Machine Learning

3 Credits

This course is a comprehensive overview of the fields of pattern recognition and machine learning. The content covers both classification and recursion, model selection, decision theory, information theory, linear and non-linear models, graphical models, kernel methods, mixture models and EM as well as neural networks. It assumes no previous knowledge of pattern recognition or machine learning concepts. Knowledge of multivariate calculus and basic linear algebra is required, and some familiarity with probability would be helpful.

Recommended Preparations: Multivariate calculus, linear algebra, probability

Cross-listed with: EE 552

CSE 584: Machine Learning: Tools and Algorithms

3 Credits

Computational methods for modern machine learning models, including applications to big data and non-differentiable objective functions.

Cross-listed with: STAT 584

CSE 585: Digital Image Processing II

3 Credits

Advanced treatment of image processing techniques; image restoration, image segmentation, texture, and mathematical morphology.

Prerequisite: CMPEN455 or E E 455

Cross-listed with: EE 555

CSE 586: Topics in Computer Vision

3 Credits

Discussion of recent advances and current research trends in computer vision theory, algorithms, and their applications.

Prerequisite: CMPEN454 or E E 454

Cross-listed with: EE 554

CSE 587: Deep Learning for Natural Language Processing

3 Credits

Natural Language Processing (NLP) is a critical part of Artificial Intelligence and Data Science. Over the past few years, deep learning based on neural networks has become the de facto approach for a wide range of NLP tasks. In this course, we will start with foundations of deep learning including multi-layer perceptrons, backpropagation, and specialized types of neural networks for different forms of data. The second part focuses on cutting-edge NLP progress. We will start with fundamental natural language understanding tasks, then cover text generation models, and progress to applications spanning different modalities and languages. We will also discuss methods for explainability, interpretability, bias and fairness, and efficiency.

Prerequisites: CMPSC 448 CSE 582

CSE 588: Large-Scale Machine Learning: Mathematical Foundations and Applications

3 Credits

This course covers various mathematical aspects of big and high-dimensional learning arising in data science and machine learning applications. The focus will be on building a principled understanding of randomized methods via a mixture of empirical evaluations and mathematical modeling. Specifically, we will explore large-scale optimization algorithms for both convex and non-convex optimization, dimension reduction and random projection methods, large-scale numerical linear algebra, sparse recovery and compressed sensing, low-rank matrix recovery, convex geometry and linear inverse problems, empirical processes and generalization bounds, as well as theory and optimization landscape of neural networks, etc. The course material builds upon the basic principles of machine learning, using multivariate calculus, linear algebra, basic probability, and algorithms. Emphasis will be on producing mathematical arguments and rigorous proofs.

Prerequisite: CMPSC 448

CSE 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

CSE 591: Research Experience in Computer Science and Engineering

1 Credits

Research experience for new doctoral students in computer science and engineering. Research is performed in conjunction with another 500-level CSE course.

Concurrent: enrollment in another 500-level CSE course

CSE 594: Research Topics

1-15 Credits/Maximum of 15

Supervised student activities on research projects identified on an individual or small-group basis.

CSE 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

CSE 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

CSE 598: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

CSE 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

CSE 601: Ph.d. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

CSE 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 3

Supervised experience in teaching and orientation to other selected aspects of the profession at The Pennsylvania State University.

CSE 610: Thesis Research Off-Campus

1-15 Credits/Maximum of 999

No description.

CSE 820: Software & Hardware Project Management

3 Credits

Students study the theory and practice of hardware and software project management. CSE 820 Software & Hardware Project Management (3) This course provides a broad exploration of the field of software, hardware, and integrated software/hardware project management. In particular, it investigates the fundamentals of risk, scope, time and cost management, quality assurance, scheduling, and human resource functions. It considers the nuances of software, hardware, and integrated hardware/software project management, as distinct

from the management of projects in, say, building construction or manufacturing. Building on these insights, the student will learn how to apply these techniques to a real-world project of his or her choosing. Students will learn to recognize, identify, and apply the functions of project management to the types of projects which they will encounter in industry. This course supports the professional nature of the MEng degree.

Counseling Psychology (CNPSY)

CNPSY 502: Advanced Counseling Theory and Method

3 Credits

Assessment, intervention, and evaluation procedures for counseling problems frequently encountered in school, college, and rehabilitation settings. CN ED 502CN ED (CNPSY) 502 Advanced Counseling Theory and Method (3)This course is concerned with the exploration of ideas that are of theoretical and applied importance to thinking about counseling and psychotherapy. The course is not a skills course, per se, although many of the readings have clear implications for enhancing your therapeutic skills. Nor is the course meant to be a review of theories of personality or counseling typically covered in earlier courses. This course is open to CN ED and CNPSY students. The prerequisite is CN ED 501.

Prerequisite: CN ED501 course open only to CN ED and CNPSY doctoral students.

Cross-listed with: CNED 502

CNPSY 554: Cross-Cultural Counseling

3 Credits

Examines theory, research, and models of counseling relationships between counselors and clients of different racial and sociocultural backgrounds. CNPSY 554CNPSY (CN ED) 554 Multicultural Counseling (3) This course is an advanced multicultural counseling course designed to help doctoral students: (a) develop mastery of the multicultural counseling literature, (b) promote self-awareness and self-knowledge, (c) facilitate the construction of cultural knowledge to increase awareness and sensitivity to issues affecting multicultural populations, (d) identify intervention strategies applicable to multicultural clients, and (e) promote development of a personal philosophy of multicultural counseling toward becoming a multiculturally competent counselor. The course is open to CN ED and CNPSY doctoral students who have successfully completed CN ED 507, CN ED 595A or CNPSY 595A, or equivalent courses.

Prerequisite: CN ED507 , CN ED595A , or CNPSY595A

Cross-listed with: CNED 554

CNPSY 555: Career Counseling

3 Credits

The examination of historical, legislative, and current models of career counseling and the development of pertinent individual and group techniques. CN ED 555CN ED (CNPSY) 555 Career Counseling (3) This course is an advanced extension of CN ED 505, Foundations of Counseling Infonation or its equivalent. In CN ED 501, students acquire a theoretical understanding of models of career development, decision-making, career education, information systems and information resources. In CN ED/CNPSY 555, students will have an opportunity to related such learning to the place of work in human behavior, models of career counseling, the role-play of such models, the practice of career

appraisal and the broad economic, social, and legislative contexts, including the global economy, stimulating current emphases on career counseling. This course is open to CN ED and CNPSY students. The prerequisite is CN ED 501.

Prerequisite: CN ED505

Cross-listed with: CNED 555

CNPSY 582: Advanced Group Psychotherapy

3 Credits

Study of group psychotherapy and interventions, with an experiential component. Available only to majors in CN ED and CNPSY.

Cross-listed with: CNED 582

CNPSY 594: Research in Counseling

2-6 Credits/Maximum of 6

The design, implementation, and evaluation of counseling research projects.

CNPSY 595: ****SPECIAL TOPICS****

1-6 Credits/Maximum of 6

Cross-listed with: CNED 595

CNPSY 595D: Supervision of Counselors

1-9 Credits/Maximum of 9

Practical experience in supervising and evaluating work of counselors.

Prerequisite: CN ED595A or CN ED595B ; available only to majors in CN ED and CNPSY

Cross-listed with: CNED 595D

CNPSY 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

CNPSY 600: Thesis Research

1-15 Credits/Maximum of 999

NO DESCRIPTION.

CNPSY 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

CNPSY 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 3

No description available.

CNPSY 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

Counselor Education (CNED)

CNED 500: Professional Counseling Orientation and Ethical Practice

3 Credits

This course provides an overview of the counseling profession and ethical practice, including a critical review of the counseling profession. Students learn the role of professional counselors as advocates for equitable access to counseling free of discrimination, systemic racism, ableism, and all forms of oppression. Topics such as professional counselor identity, areas of specialization, licensure and certification, ethical practice, responsibilities of counselors, cultural humility, and professional advocacy in counseling are addressed.

CNED 501: Counseling Theory and Method

3 Credits

Survey of psychodynamic, humanistic, behavioral and cognitive-behavioral approaches to counseling individuals.

CNED 502: Advanced Counseling Theory and Method

3 Credits

Assessment, intervention, and evaluation procedures for counseling problems frequently encountered in school, college, and rehabilitation settings. CN ED 502CN ED (CNPSY) 502 Advanced Counseling Theory and Method (3)This course is concerned with the exploration of ideas that are of theoretical and applied importance to thinking about counseling and psychotherapy. The course is not a skills course, per se, although many of the readings have clear implications for enhancing your therapeutic skills. Nor is the course meant to be a review of theories of personality or counseling typically covered in earlier courses. This course is open to CN ED and CNPSY students. The prerequisite is CN ED 501.

Prerequisite: CN ED501 course open only to CN ED and CNPSY doctoral students.

Cross-listed with: CNPSY 502

CNED 504: Foundations and Practices of School Counseling

3 Credits

This course in school counseling is a broad survey of the foundations, contextual dimensions, and practices of contemporary school counseling in Pre K-12 schools. Students develop knowledge of the roles of school counselors in addressing the developmental, personal-social, academic, and college-career needs of students in Pre K-12 schools. Students gain an understanding of the practices and interventions necessary for establishing and managing a comprehensive school counseling program. Students learn how current education reform and school contexts shape school counselors' roles. This course will provide the foundational knowledge necessary for additional school counseling courses.

CNE 505: Foundations of Career Development and Counseling Information

3 Credits

Accelerating change in economic, psychological, social, educational influences upon counselees. Utilization of information systems in effecting counselee change.

CNE 506: Individual Counseling Procedures

3 Credits

Training in listening, responding, challenging skills, and action-oriented techniques for individual counseling.

Prerequisite: or concurrent: CN ED501 ; available only to majors in CN ED and CNPSY

CNE 507: Multicultural Counseling: Foundations

3 Credits

Provide foundational information that controverts, complements and extends traditional psychology and counseling theory and practice.

CNE 508: Organization and Administration of Pupil Services

3 Credits

Principles, organization, personnel, functions, integration with school programs, evaluation.

Prerequisite: A G.P.A. of 3.00 or better in 27 credits of previous course work covering any three of the following five areas: economics, sociology, psychology, education, and anatomy and physiology.

CNE 509: Introduction to Rehabilitation Counseling

3 Credits

Provides information about rehabilitation history, legislation, philosophy, and agencies, as well as an overview of a variety of disabling conditions.

CNE 510: Foundations of Clinical Mental Health and Rehabilitation Counseling in Schools and Communities

3 Credits

This course provides an overview of the profession of clinical mental health and rehabilitation counseling. Course topics address professional identity, clinical mental health and rehabilitation settings and services, stigma and discrimination, psychosocial and cultural aspects of disability and mental health, public mental health and rehabilitation policy, and related client advocacy strategies, as well as current trends and issues affecting clinical mental health and rehabilitation counseling practice.

CNE 523: Counseling Children

3 Credits

Provides school and clinic approaches for school counselors and others mental health professionals to help children with developmental problems. CN ED 523 Counseling Children (3) Counseling children includes a range of school and clinic approaches used by school counselors and others to help children. The course combines theory and research findings with practical application of techniques so that students can develop a wide range of knowledge and skills for

integration into their individual counseling model and professional situation. Classroom work will include lecture, discussion, videos, and presentations of techniques that include role-play and case studies. The combination of these activities is designed to create a sound basis of understanding and supervised opportunities to apply techniques in school and agency settings.

CNE 524: Counseling Adolescents

3 Credits

Provides approaches for school counselors and others working with a variety of adolescent obstacles and developmental needs

CNE 525: Applied Testing in Counseling

3 Credits

Using counseling assessments effectively and ethically in applied settings, with an emphasis on test analysis and evaluation of psychometric properties.

Prerequisite: 3 credits of upper-level statistics

CNE 526: Research in Counselor Education

3 Credits

Evaluating counselor education research from scientist-practitioner perspective; emphasis on how to develop and use research with an applied focus.

CNE 530: Family Counseling: Theory and Practice

3 Credits

Conceptualization and application of family counseling frameworks to EC-12 school settings are learned in this course. CN ED 530CN ED 530 Family Counseling: Theory and Practice (3) Family functioning is paramount in the educational, personal/social, and career development of children and adolescents. This course prepares school counselors and other counselors for helping children and adolescents in the context of family. Several theories and models of family counseling are presented, focusing on application of these frameworks to work in EC-12 schools. Through experiential activities connected to the course, counselor-trainees are encouraged to relate experiences in their own families to their functioning as counselors. The course is required for a master's degree in elementary or secondary school counseling. Evaluation includes multiple-choice tests and a self-reflection project. The course objectives follow: Students will: 1 . know the terminology and basic concepts associated with systems thinking and family counseling. 2. adopt a family systems frame of reference and understand the family counseling perspective. 3. know the history and development of family counseling. 4. conceptualize the social constructionist perspective of family counseling and human functioning, including perspectives on substance use and abuse, gender, lifestyle, socioeconomic conditions, sociopolitical conditions, relations among diverse groups, and culture and identity. 5. understand and apply various frameworks of family counseling to the school counseling and school context, including Bowenian theory, attachment theory, experiential/humanistic approaches, structural and strategic approaches, cognitive-behavioral approaches, solution-focused therapy, narrative therapy, and integrative models. 6. grow in their own self-awareness with regard to their families of origin. 7. understand the use of self in counseling and learn and apply this knowledge in experiential activities and personal and professional

functioning. 8. understand the wounded healer concept and attachment theory implications for counselor functioning. 9. comprehend and delineate the relationships among family systems, schools, and community systems. 10. understand racial-ethnic, gender, cultural, socioeconomic, and lifestyle issues in the context of family, school, and community and institutional systems. 11. know how families, schools, and communities interact to influence students' development. 12. understand strategies used to promote effective teamwork among counselors, educational professionals, students, parents, schools, and communities. 13. understand communication, collaboration, and consultation with parents, educational and mental health professionals, guardians, and community members for promoting students educational, career, and personal development. 14. know and understand the structure of parenting styles and outcomes associated with each parenting style. 15. understand research on parenting styles and contrast the traditional view of adolescent development with the contemporary view. 16. apply parenting styles for various prevention and intervention strategies. 17. know research support for various prevention and intervention strategies, understand measurement associated with various theories and models, and understand research traditions and methods associated with various theories and models.

Prerequisite: CN ED501

CNED 531: Grief and Loss Counseling

3 Credits

Course focus is on counseling people with a variety of grief and loss issues.

CNED 532: Diagnosis Counseling

3 Credits

Course examines elements of counseling diagnosis, including identification and assessment of symptoms and behaviors in determining appropriate diagnoses.

CNED 554: Cross-Cultural Counseling

3 Credits

Examines theory, research, and models of counseling relationships between counselors and clients of different racial and sociocultural backgrounds. CNPSY 554/CNPSY (CN ED) 554 Multicultural Counseling (3) This course is an advanced multicultural counseling course designed to help doctoral students: (a) develop mastery of the multicultural counseling literature, (b) promote self-awareness and self-knowledge, (c) facilitate the construction of cultural knowledge to increase awareness and sensitivity to issues affecting multicultural populations, (d) identify intervention strategies applicable to multicultural clients, and (e) promote development of a personal philosophy of multicultural counseling toward becoming a multiculturally competent counselor. The course is open to CN ED and CNPSY doctoral students who have successfully completed CN ED 507, CN ED 595A or CNPSY 595A, or equivalent courses.

Prerequisite: CN ED507, CN ED595A, or CNPSY595A

Cross-listed with: CNPSY 554

CNED 555: Career Counseling

3 Credits

The examination of historical, legislative, and current models of career counseling and the development of pertinent individual and group

techniques. CN ED 555/CN ED (CNPSY) 555 Career Counseling (3)

This course is an advanced extension of CN ED 505, Foundations of Counseling Information or its equivalent. In CN ED 501, students acquire a theoretical understanding of models of career development, decision-making, career education, information systems and information resources. In CN ED/CNPSY 555, students will have an opportunity to related such learning to the place of work in human behavior, models of career counseling, the role-play of such models, the practice of career appraisal and the broad economic, social, and legislative contexts, including the global economy, stimulating current emphases on career counseling. This course is open to CN ED and CNPSY students. The prerequisite is CN ED 501.

Prerequisite: CN ED505

Cross-listed with: CNPSY 555

CNED 560: Medical and Psychosocial Aspects of Disability

3 Credits

This course is a broad survey of health conditions, including chronic illness and mental, physical, and emotional disorders and the resulting psychosocial and psychological impact on the individual. Students will be exposed to and critique the sociocultural impact of systemic inequities in healthcare access, economic opportunities, and social domains as it relates to disability and health. Students will apply disability affirmative principles, practices, and models for conceptualizing clients. For each category of disability conditions reviewed, students will gain an understanding of diagnostic criteria, appropriate treatments and interventions, supports, assistive technology, and appropriate referrals. Students will apply content on health conditions and cultural context to case studies and reflective assignments to demonstrate their mastery of the material.

Prerequisite: 9 credits in counselor education or related area

CNED 570: Lifespan Human Growth and Development in Counseling

3 Credits

Students will learn about lifespan development in counseling. Students increase knowledge and awareness of internal factors of development, such as neurobiology and physiology; and external factors, such as systemic privilege and oppression, disability, and cultural context. Students will apply developmental theories to case conceptualization and treatment planning in counseling. Students will also critically assess theories of human development and the interaction among psychological and social aspects of development for historically marginalized populations.

CNED 580: Foundations: History and Trends in Counselor Education

3 Credits

Overview of the foundations and issues relevant to the counseling profession and counselor education. Course available only to majors in CN ED.

CNED 581: Professional Issues in Counselor Education

3 Credits

Forum for doctoral students to examine and analyze issues relevant for counselor educators. Available only to majors in CN ED.

Prerequisite: CN ED580

CNED 582: Advanced Group Psychotherapy

3 Credits

Study of group psychotherapy and interventions, with an experiential component. Available only to majors in CN ED and CNPSY.

Cross-listed with: CNPSY 582

CNED 589: Seminar on Counseling Supervision

3 Credits

Study research and theoretical models of clinical supervision of counselors. Includes experiential supervision component as preparation for counseling supervision practicum.

CNED 593: Management of College and University Career Centers

3 Credits

The course focuses on the design, management, implementation, and promotion of Career Services in higher education.

Prerequisite: 9 credits in counselor education

CNED 594: **SPECIAL TOPICS**

3 Credits

CNED 594A: Research Topics

3 Credits

The design, implementation, and evaluation of counseling research projects.

CNED 595: **SPECIAL TOPICS**

1-6 Credits/Maximum of 6

Cross-listed with: CNPSY 595

CNED 595A: Counseling Practicum

1-6 Credits/Maximum of 6

Practice in the application of guidance principles and methods to cases counseled under supervision; case conferences; seminar in guidance techniques

Prerequisite: CN ED505 , CN ED506 , CN ED525 ; available only to majors in CN ED and CNPSY

CNED 595D: Supervision of Counselors

1-9 Credits/Maximum of 9

Practical experience in supervising and evaluating work of counselors.

Prerequisite: CN ED595A or CN ED595B ; available only to majors in CN ED and CNPSY

Cross-listed with: CNPSY 595D

CNED 595E: School Counseling Internship and Seminar

3-6 Credits/Maximum of 9

The School Counseling Internship provides a closely supervised field experience in involving the full range of duties involved with professional school counseling in Pre-K-12 schools. Students are expected to utilize every opportunity to become familiar with and participate in the services provided by the schools and related organizations with which they are associated. The expectation is that the Internship student should be providing the same range of services for the school district that the other school counselors provide. In this course, you are expected to engage in various counselor roles at your site, including (a) program development and evaluation; (b) counseling: individual, group, group guidance; (c) program administration and leadership; (c) collaboration, coordination, and consultation: work with parents, teachers, administrators, community members, and other appropriate stakeholders; and (d) assessment, career development, program coordination, and other important and appropriate roles.

CONCURRENT: CNED 504

CNED 595G: Counseling Internship and Integrative Seminar

1-6 Credits/Maximum of 12

CN ED 595G Counseling Internship and Integrative Seminar (3-6 per semester/maximum of 12) This course will provide students with opportunities to apply principles and techniques that facilitate the counseling process by completing a supervised 600-hour counseling internship experience. Students must have successfully passed CN ED 595A (Practicum) and gain permission from the Emphasis Coordinator before they can begin their counseling internship. Students are also required to have professional liability insurance as a prerequisite for the counseling internship.

Prerequisite: CN ED595A

CNED 595I: Counselor Education Doctoral Internship

3-6 Credits/Maximum of 9

Practical experience in professional counseling & higher education teaching under supervision available only to CN ED doctoral students. This course provides Counselor Education doctoral students with opportunities to apply principles and techniques that expand their counseling and higher education teaching experiences by completing an individual and group supervised internship. A minimum number of total hours required by accreditation must be acquired to meet the program required total 6 credit hours. This is a culmination course that provides for professional demonstration of information and skills developed in preceding courses in the doctoral program. Students in the course will meet the following objectives: a. Demonstrate a personal theoretical counseling orientation that is based on a critical review of existing counseling and teaching theories. b. Demonstrate effective application of theory and professional best practices. c. Demonstrate an understanding of counseling case conceptualization and effective interventions across diverse populations and settings. d. Develop and demonstrate a personal philosophy of teaching and learning. e. Demonstrate course design, delivery, and evaluation methods appropriate to course objectives. f. Demonstrate the ability to assess the needs of counselors in training and develop techniques to help students develop into competent counselors.

CNED 595P: Counselor Education Doctoral Counseling Practicum

3 Credits

Practice in the application of counselor education principles and methods to cases counseled under supervision; case conferences. Available only to CN ED doctoral students.

CNED 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

CNED 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

CNED 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

CNED 601: Thesis Preparation

0 Credits/Maximum of 999

No description.

CNED 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Teaching of counselor education laboratory, clinical practice, and recitation classes under senior faculty supervision.

CNED 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

CNED 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

CNED 843: Prevention Strategies and Programming

3 Credits

Addresses prevention program development, implementation, and evaluation, along with theoretical and empirical underpinnings, ethical and multicultural issues related to prevention.

Cross-listed with: SPSY 843

Criminal Justice (CRIMJ)

CRIMJ 500: Advanced Criminological Theory

3 Credits

This course reviews and critiques the major theories of crime causation. CRIMJ 500 CRIMJ 500 Advanced Criminological Theory (3) This course provides students with an understanding of the major theories of crime causation. Students completing this course will (1) articulate the historical development of criminological theories over the last three centuries; (2) critically assess the usefulness of theory to the development of sound crime-related policy; and (3) delineate the strengths and weaknesses of each theory. Since the course serves as a foundation class for the other core requirements, it should be taken by students in their first semester. Students taking this course will be required to lead class discussions, write a significant research paper, and take essay format examinations.

Prerequisite: admission to CRIMJ graduate program or permission of program

CRIMJ 501: Advanced Research Methods for Criminal Justice

3 Credits/Maximum of 999

Advanced research methodology for criminal justice and criminology. The purpose of this course is to assist students in becoming both critical consumers and producers of scientific research. Through an understanding of research methodology, the student should be better prepared to determine the adequacy of findings from studies reported in both technical research reports and in academic journals. Further, students should be able to plan, implement, and assess the outcomes of studies that they might initiate.

CRIMJ 502: Public Policy and the Criminal Justice System

3 Credits

This course studies the concepts and methods of political and legal activity within the criminal justice system and their impact on society. CRIMJ 502 CRIMJ 502 Public Policy and The Criminal Justice System (3) The purpose of this course is to focus on crime policies in terms of effectiveness, efficiency, resource allocation, and societal impact. This course forms a nexus between the legal reasoning of criminal law with the theoretical and research foundations of the discipline. Crime control appears to be centered within the political community often without adequate, fair, or pertinent analysis of policy design or implementation. This course will use legal precedent to discuss the past and apply such a precedent to current issues. Students will examine how political assessments of crime is no guarantee that the resulting policy will deter the behavior. The nexus between research, criminal law, and the expectation of justice often come from disparate views about the goal of the criminal justice system. This course will also examine the goal of justice amid diverse populations. How has racial disparity in sentencing, legal representation, the death penalty, judicial representation, and political careers persisted? Students will also study comparative issues of national and international law. Finally, students will address a policy issue by submitting a policy analysis research proposal followed by a policy analysis paper.

Prerequisite: a baccalaureate in Criminal Justice or Behavioral related Sciences and admission to graduate study

CRIMJ 503: Advanced Statistics in Criminal Justice

3 Credits

Advanced statistics in criminal justice and criminology. The purpose of this course is to teach the student the theory behind a particular statistical technique and its appropriate use. As such, it focuses on: (1) the theory of statistical procedures; and (2) the analysis of computer-generated output. Through classroom discussions, reading assignments, and out-of-class exercises, the student will learn which statistical technique is appropriate with regard to the research hypothesis and the level of measurement of the variables included in the analysis. Further, through data analysis using SPSS, the student will learn how to interpret the output from that analysis.

Concurrent: CRIMJ501

CRIMJ 504: Criminal Justice Organization and Management

3 Credits

The course will be a broad overview of the structure and management of criminal justice organizations. CRIMJ 504 Criminal Justice Organization and Management (3) The purpose of this course is to provide students with the ability to assess substantive policy issues regarding the organization and management of criminal justice agencies, to explain the rudiments of the day-to-day functioning of criminal justice organizations, and, most important, to get students actively engaged in discussing and thinking critically about what they consider to be good organization and management principles and policies. In addition to the text, students will be instructed to consult criminal justice and public administration journals for the most up-to-date ideas and concepts in organizational management. In particular, students should (1) understand the nature of criminal justice organizations; (2) understand the importance of effective communication and motivation of rank-and-file employees; (3) comprehend the necessity of the use of power and decision making; and (4) the necessity of change and research in criminal justice organizations. This course will be offered once every other semester, and it should be a first-semester requirement.

Prerequisite: admission to graduate study and permission of program

CRIMJ 563: Concepts and Practices in Police Administration

3 Credits

Discusses application of police research and management principles to the contemporary policing context. CRIMJ 563 Concepts and Practices in Police Administration (3) This course examines the multitude of factors involved in the delivery of protective services to a diverse community. The evolution of policing from its English, quasi-militaristic heritage will be analyzed in order to gain foundational knowledge for understanding its current problem-solving, community orientation. Method for attaining a community partnership will be explored. Means for attaining accountability within the new organizational philosophy will be identified. Important issues such as use of force, cultural awareness, integrity, and ethics will be extensively reviewed.

Prerequisite: permission of program

CRIMJ 564: Administrative and Legal Aspects of Corrections

3 Credits

This course addresses historical and contemporary correctional policy, accountability, and possible remedial alternatives. CRIMJ 564

Administrative and Legal Aspects of Corrections (3) CRIMJ 564 is the historical, administrative, and legal inquiry into the development of institutional and community criminal punishment. Currently, corrections has nearly a 70% recidivism rate. Corrections is the measure of the cost of doing crime and cultural changes which redefine that cost. CRIMJ 564 will provide a macro-perspective into the mechanics of designing and reforming the process of capital punishment.

Prerequisite: permission of program

CRIMJ 565: Courts in the Criminal Justice System

3 Credits

An analysis of the function and role of the courts and the personnel involved in the American criminal justice system. CRIMJ 565 Courts in the Criminal Justice System (3) The course will deal with the nature and function of the courts and their personnel within the American criminal justice system. In relation to the structure and organization of the courts, the differences in court systems and functions will be examined, as well as proposals for reform of these structures and organization in light of concerns over increasing caseloads, other docket pressures, and a variety of other issues. The course additionally examines the personnel involved in the court processes of the criminal justice system in their function, education and training, selection, role orientations and examines the implications of these factors in how they exercise decision-making power. Proposals for reform of decision-making functions of prosecutors, defense attorneys, and judges will be examined in light of the interrelated functioning of personnel within the courts.

Prerequisite: permission of program

CRIMJ 567: Juvenile Justice: Issues and Practice

3 Credits

The systematic application of the juvenile justice system and issues related to juvenile delinquency and constitutional law. CRIMJ 567 Juvenile Justice: Issues and Practice (3) This course introduces the juvenile justice system and issues associated with processing youth through that system for graduate study. The course first addresses how there came to be a separate system for juveniles in this country and explores the major philosophical foundation for that separate system. Further, the course encourages the student to think about how delinquency is defined and the challenges those definitions have faced. In addition to exploring how youth are processed through the juvenile justice system (from arrest to disposition of the case), the course also provides the student with an exploration into issues associated with minorities and females. Critical issues of importance to juvenile justice administrators will be covered in this course as well since many CRIMJ graduates will go on to serve as administrators in the criminal justice field. Students will be asked to think critically about the future of the juvenile justice system as the system moves beyond the original intent of its framers. This course should provide the student with a better understanding not only of how the juvenile justice works, but also of how the system has dealt with challenges that it has faced since its first inception in 1899. This course will be offered once a year.

Prerequisite: permission of program

CRIMJ 568: Qualitative Methods for Criminal Justice

3 Credits

This course examines the many facets of qualitative research methodology. CRIMJ 568 CRIMJ 568 Qualitative Methods for Criminal Justice (3) The purpose of this course is to train the student how to conduct a good qualitative study. This will be achieved by introducing the students to various methods of data collection used in qualitative research. Specifically, the student will study qualitative methods such as, case study analysis, observer as participant, covert participation, as well as effective interviewing. The student will examine examples of notable qualitative studies to increase their understanding of the various concepts associated with qualitative research.

Prerequisite: Admission to a graduate program or permission of program.

CRIMJ 569: The Death Penalty

3 Credits

This course provides students an overview of a wide range of works within the topic of the death penalty authored by the most renowned experts in the field. Various issues examined include legislative challenges, racial discrimination, wrongful conviction, cost, deterrence, mitigation research, and the role of health and mental health professionals. Through landmark U.S. Supreme Court cases, influential meta-analyses on empirical studies, and legal analyses, this course provides an in-depth look at the theory, research, policy, and practice of this punishment, and discusses the limitations of current empirical approaches and the gap between practice and penological ideals.

Prerequisite: CJPA501 and CJPA502 or permission of the instructor
Cross-listed with: CJPA 569

CRIMJ 570: Forensic Victimology

3 Credits

Forensic victimology provides students with a basic understanding of the field of victimology and its historical developments. Through the use of statistical and theoretical application, students will better understand how to create victim profiles and how these profiles inform violence prevention, practice, and policy. Students will gain a basic understanding of threat assessment at the individual and community level, as well as safety planning strategies that are used to support crime and victimization prevention efforts. Further, forensic victimology provides an overview of the victim's role in the criminal justice system from investigation to intervention.

Cross-listed with: CJPA 570

CRIMJ 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers. CRIMJ 590 CRIMJ 590. Colloquium (1-3) This common course will focus on specific issues within each colloquia. Issues to be covered will be research, resources allocation, legal issues, and impact on crime control. This course will direct students to study the design and implementation of policies to address specific issues. The course will add to the diversity offerings within the Master of Arts in Criminal Justice. This course will be offered in the summer and the

spring with an enrollment of 20. Repeatable credit is possible. It will be offered more if enrollment patterns warrant such an increase.

CRIMJ 594: Research Topics

1-15 Credits/Maximum of 15

Supervised student activities on research projects identified on an individual or small-group basis. CRIMJ 594 CRIMJ 594. Research Topics (1-12) This common course will focus on specific research issues. Issues to be covered will be resources allocation, legal issues, and impact on crime control. Students will study the design and implementation of topical issues as they address specific issues. The course will add to the diversity offerings within the Master of Arts in Criminal Justice. This course will be offered every third semester.

CRIMJ 595: Internship

1-18 Credits/Maximum of 18

Supervised off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required. CRIMJ 595 CRIMJ 595. Internship (1-18) The purpose of this course is to introduce students to the ethics, operations, and standards of working within a criminal justice environment. This course is individualized for each placement and student. It is offered in cooperation with the program, the internship site, and the goals of the student. An overall objective is to familiarize students with the legal and professional standards associated with working with people as colleagues, program participants, or clients. Students will be expected to comprehend the guidelines associated with legal and social service agencies. The internship will enable students to apply these guidelines under novel and unique situations. This course will be offered each semester with an enrollment of ten students. It will be offered more if enrollment patterns warrant such an increase.

Prerequisite: The applicant must have complete CRIMJ500, CRIMJ502, CRIMJ504 plus three other Masters credits. The applicant also must have a GPA of at least 3.25

CRIMJ 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

CRIMJ 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

Criminal Justice Policy and Administration (CJPA)

CJPA 501: Criminal Justice Institutions

3 Credits

This course provides a broad understanding of the social science study of criminal justice institutions and their decision-making processes. Criminal Justice Institutions focuses on the social scientific study of criminal justice institutions and their decision-making processes. The course presents an overview of key issues in theory and research on

each major sector of the criminal justice system: policing, prosecution, criminal defense, courts, and corrections. The course also discusses the societal impact of these criminal justice sectors, and the relationship between research and criminal justice policy.

CJPA 502: Theories of Crime

3 Credits

This course provides a survey of social science theories of criminal behavior at the individual and group levels. Theories of Crime provides an advanced survey of social science theories of criminal behavior at the individual and group levels. The course begins with an examination of the empirical study of crime, with an emphasis on crime data and its sources. The course progresses through biosocial, psychological, and sociological theories. The overarching emphasis of the course is to understand explanations of criminal behavior at the individual level and variations in crime rates at the group level.

CJPA 569: The Death Penalty

3 Credits

This course provides students an overview of a wide range of works within the topic of the death penalty authored by the most renowned experts in the field. Various issues examined include legislative challenges, racial discrimination, wrongful conviction, cost, deterrence, mitigation research, and the role of health and mental health professionals. Through landmark U.S. Supreme Court cases, influential meta-analyses on empirical studies, and legal analyses, this course provides an in-depth look at the theory, research, policy, and practice of this punishment, and discusses the limitations of current empirical approaches and the gap between practice and penological ideals.

Prerequisite: CJPA501 and CJPA502 or permission of the instructor
Cross-listed with: CRIMJ 569

CJPA 570: Forensic Victimology

3 Credits

Forensic victimology provides students with a basic understanding of the field of victimology and its historical developments. Through the use of statistical and theoretical application, students will better understand how to create victim profiles and how these profiles inform violence prevention, practice, and policy. Students will gain a basic understanding of threat assessment at the individual and community level, as well as safety planning strategies that are used to support crime and victimization prevention efforts. Further, forensic victimology provides an overview of the victim's role in the criminal justice system from investigation to intervention.

Cross-listed with: CRIMJ 570

CJPA 803: Applied Research Methods

3 Credits

This course provides a survey of social research methods tailored to the field of criminal justice. This course provides a survey of social science research methods, applied to the study of criminal justice topics and the evaluation of criminal justice policies. The course discusses different sources of crime and justice data, survey research methods, experimental and quasi-experimental approaches, qualitative research approaches, and legal research. The course emphasizes the illustration of types of

research methods with examples from criminal justice research and policy evaluation.

CJPA 808: Capstone Project in Criminal Justice Policy and Administration

3 Credits

This course is a requirement for all students in the M.P.S. in Criminal Justice Policy and Administration. During their final semester, the student will work closely with a faculty adviser (selected to match the student on substantive and/or methodological expertise) on a self-selected criminal justice and policy administration-related capstone project. The student is expected to draw on data and methods encountered during their prior course work. At the end of the semester, the student will be required to make a formal peer presentation to other enrolled students and all their faculty advisers. The student also will be required to submit a final report/paper to their faculty adviser by the end of the semester.

Prerequisite: CJPA 501, CJPA 502, CJPA 803, CJPA 820, CJPA 865, CRIMJ 503

CJPA 820: Criminal Procedure

3 Credits

This course provides a survey of criminal procedure and related constitutional law. Section 1 of the course explores the origins and evolution of criminal procedure, from its ancient roots through colonial times, the due process revolution, and modern law. Section 2 examines sources of modern criminal procedure, including statutory law, Supreme Court opinions, other case law, rules, regulations, and organizations' rules and regulations. Section 3 examines the Fourth Amendment and the evolution of search and seizure laws, including arrests, proper use of force, search warrants, and searches of places and things. This section presents older and more recent psychological conceptions of crime. Section 4 examines the Fifth Amendment, the federal due process clause, and the right to be free from forced self-incrimination; the Confrontation Clause; and the rights and responsibilities of all related criminal justice stakeholders in relation to these issues, including victims and defendants. Section 5 examines the Sixth Amendment, the right to counsel, evidence procurement and development, and criminal trial procedures. Section 6 examines the Eighth Amendment, the relationship between the Eighth and Fourteenth Amendments, pretrial versus post-conviction procedures, sentencing and correctional procedures, and the cruel and unusual punishment clause. Section 7 examines the Fourteenth Amendment, substantive due process clause, the equal protection clause, civil rights litigation, and the role of the writ of habeas corpus in criminal procedure. Section 8 allows students to demonstrate that they have mastered the above through a case study of a criminal case that has occurred within the past twelve months, or is ongoing.

CJPA 830: Global Policing

3 Credits

This course is designed to cover topics related to global policing and police cooperation against global crime activities. Students will study how police organizations from different countries communicate, cooperate, and collaborate with each other in order to respond global crime threats. This course will start with comparing and contrasting police systems in different countries to give an idea about similarities and differences among police organizations around the world. Then, the emergence of global policing will be discussed to understand the historical development of police cooperation in the world. Theoretical

frameworks for global policing will be covered to understand the change in the area of policing from local, state, and national levels to an international level. In this course, students will also analyze current global crime trends and understand the necessity of global policing. Moreover, international treaties and laws as well as international organizations against global crime will be discussed to examine the legal foundation and the structure of global policing. Bilateral and multilateral police cooperation initiatives will be studied to see how police agencies from different countries collaborate with each other. The role of U.S. law enforcement agencies in global policing and their assistance to other countries' police forces will be reviewed to evaluate the effectiveness of U.S. agencies in global police collaboration. This course will also analyze peace operations to understand the role of international organizations as well as the U.S. in providing police assistance in order to restore order and create a sustainable society after a war or a civil unrest in a country. Best practices in police cooperation will also be discussed to give an idea about the effective working of police cooperation in practice and challenges and opportunities in police cooperation will be studied to understand the success and failure factors in police cooperation. This course will conclude with a discussion of the future of global policing to identify forthcoming issues and possibilities in global policing.

CJPA 831: Transnational Crime

3 Credits

This course is about transnational crime activities happening around the world. Crime and criminal activities have become transnational due to globalization and advances in technology. The course will start with analyzing the universe of transnational crime to understand the current trends in transnational crime activities and the role of organized crime groups in these criminal activities. Students will study different types of transnational crimes every week to explore current issues related to crimes occurring beyond national borders. Transnational crimes such as drug trafficking, migrant smuggling, human trafficking, arms trafficking, counterfeiting, cybercrime, environmental crime, and money laundering will be analyzed to understand how transnational criminals commit these crimes, what types of strategies and tactics they use, and how law enforcement agencies try to fight against these crimes at the local, national, and international levels. Global responses and the U.S. response against transnational crimes will also be studied to evaluate the role of international organizations as well as the U.S. in the fight against transnational crime.

CJPA 832: Policing Terrorism

3 Credits

This course aims to understand the role of law enforcement in counterterrorism by analyzing the challenges, issues, and difficulties in policing terrorism. Root causes, strategies, and tactics of modern terrorist organizations are studied to understand the underlying motivations and the modus operandi of terrorist organizations. Law enforcement responses and contemporary policing strategies to fight terrorism are studied to evaluate their effectiveness in counterterrorism. Policing efforts to fight against domestic and international terrorist activities are also discussed to understand the new issues and challenges in policing global terrorism.

CJPA 833: Courts and Sentencing

3 Credits

This course is an examination of theory, research, and policy involving courts and their sentencing decisions. The course aims to translate social science research and theory on courts and sentencing into useful perspectives and knowledge for criminal justice practitioners and policy analysts. The course discusses sentencing decisions and how they are shaped by law and policy, the social organization of local courts, and the decision-making discretion of judges, prosecutors, and defense attorneys. In addition, the course considers the pros and cons of various research strategies for evaluating sentencing policies in an evidence-based way.

CJPA 865: Criminal Justice Ethics in a Diverse Society

3 Credits

This course provides a survey of ethical systems and theories. Section 1 provides an overview of the study of ethics, with definitions and a discussion of the parameters of ethical analysis. Section 2 presents the major ethical systems (utilitarianism, ethical formalism, religion, ethics of care, virtue ethics). Section 3 examines the origins of the concept of justice, distributive justice, corrective justice, substantive justice, procedural justice, immoral laws and the moral person, and restorative justice. Section 4 explains the theories of moral development, biological factors, learning theory, Kohlberg's moral stage theory, teaching ethics, and avoiding cynicism and burnout. Section 5 discusses the role of police in society as a crime fighter or public servant, police power and discretion, and the police subculture. Section 6 examines police discretion and discrimination, discretion in criminal investigations, and discretion and the use of force. Section 7 examines police misconduct and corruption as a worldwide problem, including international measures of corruption, on-duty use of drugs and alcohol, sexual misconduct, and criminal behavior by police. Section 8 examines the role of law, the law and legal behavior, justifications for law, and the various paradigms of law. Section 9 presents issues of discretion and dilemmas for the defense and the prosecution. Section 10 discusses ethical misconduct in the courts and the explanations and methods of response to the misconduct. Section 11 describes the issues involving discretion of correctional officers, treatment staff, and probation and parole officers.

Criminology (CRIM)

CRIM 500: Overview of Graduate Studies in Criminology

1 Credits

An overview of professional activities of scholars of criminology and Penn State's program in this field. CRIM 500 Overview of Graduate Studies in Criminology (1) This course is intended for new students in the Criminology graduate program. Its purpose is to speed their transition to graduate study and to provide a good start for their professional socialization. The course offers an overview of many of the professional activities of scholars of criminology and of Penn State's program in this field. This includes writing, publishing, teaching, and seeking funding. A major goal of the course is to help students see beyond the immediate priority of success at course work to the longer term priorities of success in these other arenas. The course is organized around a series of guest speakers from the program faculty who will discuss a range of activities that are a part of the professional life of research scholars. It also provides a forum for graduate students to get to know the faculty. The tone of the discussion is conversational. Speakers welcome questions

both about the particular topic of the week and about the speaker's professional/research activities.

CRIM 501: Criminal Justice Organizations and Institutions

3 Credits

Organizations and institutions involved in the formulation and implementation of criminal justice policy in complex social and organizational environments. CRIM 501 Criminal Justice Organizations and Institutions (3) Organizations and institutions involved in the formulation and implementation of criminal justice policy in complex social and organizational environments.

CRIM 512: Criminological Theories

3 Credits

Survey of theoretical and substantive issues in deviance and criminology, with emphasis on critical review of theories. SOC (CRIM) 512 Criminological Theories (3) This graduate course in Criminological Theories is designed to provide students with a broad understanding of the major theories that have animated the field of criminology since its inception. The course traces the development of criminological theories from the early 20th century to the present and provides students with a targeted exposure to empirical studies that have tested these theories.

Cross-listed with: SOC 512

CRIM 513: Theory Testing and Manuscript Writing in Criminology

3 Credits

This course critically examines innovative strategies criminological researchers take to test theory, evaluate policy, and contribute to the field. With recent scholarly examples, the course overviews the feasibility and relevance of the various approaches for graduate research, culminating in the opportunity to apply a strategy to individual research and peer review of final course papers.

CRIM 520: Moral Criminology

3 Credits

"Moral Criminology" provides a comprehensive understanding of the role of moral ideas, beliefs, and intuitions in the occurrence of crime and analogous behavior and in the application of punishment. How do we decide if a behavior is morally right or wrong, or if someone deserves praise or punishment? Under what conditions do our moral principles, intuitions, and emotions influence whether we follow or break rules or laws? Under what conditions do they influence our attitudes towards such behavior in others? This course integrates perspectives from criminology, sociology, psychology, and philosophy and prepares students to interpret and conduct research on the relationship between morality and crime. Part One of the course examines a variety of approaches for conceptualizing morality. Part Two reviews existing research on morality and crime. Part Three reviews existing research on morality and punishment.

CRIM 533: Social Contexts of Criminal Sentencing

3 Credits

This course is an in-depth, advanced examination of sociological and criminological theory, research, and methodological issues in the empirical study of the social and organizational environment of

criminal courts and their sentencing decisions. The course discusses sentencing decisions as a function of the complex interplay between formal legal norms, the social organization and culture of local courts, the social environment surrounding courts, the interactions between court participants, and the social psychology of court actors. In addition, the course considers the pros and cons of various empirical research strategies in studying sentencing decisions.

CRIM 559: Communities and Crime

3 Credits

Crime has been shown to differ significantly across neighborhoods of different racial composition and of different socioeconomic characteristics. Specifically, neighborhoods characterized by high poverty and high segregation are more likely to exhibit higher violence, higher homicide rates, and higher disorder. Moreover, growing up in a highly disadvantaged neighborhood predicts whether youth will be involved in delinquency, risky behavior, and violent crime. In this course, students will learn about the major debates and arguments in the field on how such differences can come about and what may be their consequences. Students will learn to recognize, identify, and apply criminological and sociological theories and thinking on the effects of neighborhoods' social structures on crime. In particular, we will focus on classic and contemporary cutting edge thinking on poverty, social isolation, disorder, collective efficacy, institutional (dis)trust, demographic v. cultural heterogeneity, segregation, immigration, and the physical environment. We will address the theories, methods, and policies related to understanding key features of places such as social (dis)organization, social capital, spatial embeddedness, opportunity infrastructure, and cultural capital.

Cross-listed with: SOC 559

CRIM 591: Teaching Sociology/Criminology

1 Credits

Preparation for teaching sociology and/or criminology at the college level. CRIM (SOC) 591 Teaching Sociology/Criminology (1) Preparation for teaching sociology and/or criminology at the college level.

Cross-listed with: SOC 591

CRIM 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

CRIM 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

CRIM 597E: Networks & Crime

3 Credits

A seminar on the study of social networks and crime, including research on interpersonal influence, co-offending, and illicit commerce.

CRIM 597F: CRIME & HEALTH

3 Credits

Topics include overlapping theories in criminology and epidemiology, bio-social explanations of crime/deviance, and collateral health consequences of crime and punishment.

CRIM 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

CRIM 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

CRIM 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

Curriculum and Instruction (CI)

CI 500: Multiple and Mixed Methods in Curriculum Inquiry

3 Credits

Multiple and mixed methods of inquiry to investigate problems in the practice of curriculum and instruction. C I 500 C I 500 Multiple and Mixed Methods in Curriculum Inquiry (3) This course focuses on practice-embedded curriculum inquiry and surveys an array of approaches and methods that are quantitative, qualitative or both. The course is intended as a gateway seminar to other C&I disciplined inquiry courses (i.e., C&I 501, 502, 503) in which curriculum and instruction students can discuss and participate in learning activities related to the readings and in which guest speakers can inform C&I graduate students about current issues and topics related to systematic inquiry with application to curriculum and instruction.

CI 501: Teaching as Inquiry

3 Credits

Course guides teachers to develop systematic inquires into effective teaching and learning.

CI 502: Qualitative Research in Curriculum and Instruction I

3 Credits

Presentation of theoretical and practical issues related to designing and proposing qualitative research concerning curriculum, teaching and/or learning.

Prerequisite: admission to a doctoral program**CI 503: Qualitative Research in Curriculum and Instruction II**

3 Credits

Considers forms of qualitative data, data analyses, procedures to generate data relationships, interpretation, and presentation of data.

Prerequisite: C I 502**CI 511: Educational Ethnography: History, Theory, and Methods**

3 Credits

This seminar shows students how to use ethnographic methods for education research to inform classroom practice and education policy. The course is centered around the idea that school communities serve as key sites for students of all ages to learn to become members of their culture(s). Course readings include historical to contemporary works of researchers who have shaped educational ethnography. We will also read about education in various settings and discuss anthropological explanations of inequities experienced by minority culture communities or marginalized groups. Students will carry out a mini-ethnographic study based on their area of research interest. The course is especially designed for students to be able to conduct ethnographic studies or make use of ethnographic techniques in future research projects.

Prerequisite: (C I 502; ADTED 550; EDTHP 586;)

Cross-listed with: CIED 511

CI 512: Contemporary Educational Ethnography

3 Credits

Recommended Preparations: Qualitative Research course or permission of instructor. This seminar shows students how to use contemporary ethnographic theories and methods for education research to inform educational practice and policy. The contemporary movement might arguably be situated in the controversies of the 1980s and 90s, exemplified in Clifford and Marcus's book, *Writing Culture*, in which they identified the epistemological and political predicaments and controversies pertaining to "the crisis of representation" in the field of anthropology. CI 512 addresses methodological and theoretical approaches informed through literary, reflexive, postmodern, poststructural, feminist, multisensory, multimodal, multivocal, and postcolonial turns and the ways in which they inform educational ethnography. The course focuses on a comprehensive view of education-schools, cultural and community centers, home life- as sites for all ages to learn to become members of their culture(s). A significant and regularly occurring aspect of the class involves students engaging in contemporary ethnographic practices such as cartographic, photographic/videographic, arts-based, alternative writing, walking/movement, sensory, performative, and multimodal. The course will intersperse readings of ethnography with readings about ethnography, largely within the contemporary sphere. The focus will be on contemporary movements that are likely to affect students as they consider ethnographic approaches for their dissertation topics (e.g. science education, musical training, literacy practice, critical race pedagogy).

CI 513: Video Ethnography in Education

3 Credits

Recommended Preparations: A graduate course in educational ethnography This seminar will show students how to use video ethnography in education research. The course is rooted in what is popularly known as the Preschool in Three Cultures method (also known as video-cued multivocal ethnography). We will learn about and watch films using video-based ethnographic research methods. Students will also carry out mini-video ethnographies in a local classroom.

Prerequisite: C I 502; ADTED 550; EDTHP 586; LDT 574

Cross-listed with: CIED 513

CI 515: Foundations of Educational Research

3 Credits/Maximum of 999

Students read the philosophical foundations of education research, study how philosophies influence methodologies, and analyze current educational problems. This course is designed for students entering doctoral programs in the College of Education. Our students are studying to become education researchers within a highly politicized environment. For example, particular definitions of education research and government policies that favor some types of research practices over others provide opportunities for and set limits upon the work of education researchers. Public controversies likewise contribute to challenges faced by education researchers who find their work affirmed or discounted by particular definitions and policies. In order to explore these controversies and to allow students to begin identifying their own "positionality" with regard to research, this course begins with a reading of the history and philosophies of education research (primarily focusing on the United States). The course goals are: - to identify underlying assumptions of competing forms of social inquiry, each determined to uncover new knowledge; - to bring those assumptions to bear on education research in chosen fields of study; and - to begin to develop one's own positions in order to direct further study and research. Specifically, through instructor facilitation and group discussions, students will come to understand major philosophical perspectives that permeate and drive research methodologies in education: positivism, postpositivism, interpretivism, critical theory, poststructuralism, and pragmatism. These understandings allow students to recognize the methodological assumptions that inform published research studies and to discover how methodologies might inform the research they wish to conduct as students and practitioners. Although the course is not required by any particular doctoral program in the College of Education, it is suggested for students who consider research important to their future careers and who see benefits in exploring the methodological options available.

Cross-listed with: ADTED 515, EDPSY 515, HIED 515

CI 517: Core Readings in Vygotsky's Cultural Historical Psychology

3 Credits

The Sociocultural or Cultural Historical theory of mind originated in the writings of Russian psychologist L.S. Vygotsky during the 1920s and 30s. Over the course of only about ten years, Vygotsky and his circle produced a substantial body of theoretical and empirical work that challenged basic epistemological and ontological premises of psychology and that outlined a new way of understanding human abilities and their development. The framework Vygotsky elaborated has come to be referred to as Cultural Historical psychology, emphasizing the fundamental role of mediation in shaping human psychology, mediation through historically created artifacts available in particular cultures and through forms of social interaction. In the decades since Vygotsky's death, Cultural Historical psychology has been further developed by researchers around the world who have brought Vygotsky's theoretical proposals to bear on questions and problems as diverse as special education, psychological and educational measurement, early childhood education, psycho-therapy, teacher education, linguistics and communication, adult and workforce education, and political and social change. The course is organized around carefully selected, seminal readings, emphasizing primary texts authored by Vygotsky but complemented by secondary sources generally regarded as leading interpretations. Beginning with an examination of Vygotsky's enterprise

to establish a unified, scientific psychology grounded in Marxian dialectics (historical materialism), the course engages with concepts and principles definitive of Cultural Historical psychology that in some cases have become highly influential in a number of disciplines and that in others are only beginning to be understood. These include mediation, Zone of Proximal Development/ZPD (zona blizhaishego razvitiya/ZBR), spontaneous and scientific concepts, teaching/learning-and-development (obuchenie), inner and private speech, units of analysis and meaning (znachenie/smysl), and perezhivanie, among others. In this way, students obtain a deep understanding of the theory, both in the context of Vygotsky's own writings and the specific problems he sought to address but also in its contemporary applications. This understanding, in turn, enables students to critically evaluate uses of Vygotsky's ideas in their particular area of study while also providing the background necessary to employ the theory in their own research. The course is intended for students in all areas of education, human development, and applied linguistics. No previous knowledge of Vygotsky's work is required.

CI 520: Democratic Education

3 Credits

Americans have long considered their public schools to be central in the cultivation of democracy. As such, public school teachers in the United States-at all levels and of all subjects-play a key role in perpetuating democracy. Despite teachers' critical role, formal preparation for this task via professional development of teacher education is questionable at best. Little scholarly attention is paid to what teachers need to know or be able to do pedagogically to help cultivate democratic thinking in students and rarely is the responsibility extended to teachers outside of the social studies field. This course takes seriously the role of democratic practice in education writ large, asking students to consider the purposes, theories, practices, and possibility of democratic education across a variety of contexts: adult education, K-12 education, alternative education, and teacher education. In this course we will consider the purposes of democratic education in the current U.S. context, examine theories of democratic education for democracy, and explore models of democratic education in practice.

CI 521: Crafting the Systematic Literature Review in Education

3 Credits

This course is a graduate level seminar designed for students who would benefit from learning how to conduct a systematic and analytical literature review. This course is appropriate both for graduate students in the early stages of determining a thesis or dissertation topic, and as well as advanced doctoral students who aim to engage in a systematic review of the literature in their chosen field. Class participants will critically analyze model literature reviews; determine criteria for inclusion and exclusion of research studies; systematically gather publications using academic databases; analyze and organize pertinent literature; and write a literature review focused on their topic of interest. The course follows a cognitive apprenticeship model of learning, such that the skills and processes involved in writing a literature review in education research will be taught within the context of the doctoral student participants' own research interests and will be explored and practiced within their professional and program objectives.

CI 525: Bakhtin and Education

3 Credits

This seminar gives students an overview of the writings of key members of the "Bakhtin Circle," which included Mikhail Bakhtin, Valentin Voloshinov, Pavel Medvedev, and others. The core objective of this course is for students to learn about Bakhtinian theory and how to use Bakhtin as a philosophical method in carrying out research studies and analyzing data. In order to do this, we will read the original works of Bakhtin, Voloshinov, Medvedev, and others alongside contemporary educational researchers, theorists, and methodologists who apply Bakhtinian philosophical methods and analyses to the study of education.

Cross-listed with: CIED 525

CI 528: Theories of Identity

3 Credits

Survey of 20th century theories of identity from post-colonial, critical race, psychoanalytic, Marxist, and post-structural feminist and queer perspectives.

CI 529: Foucault in Education

3 Credits

Reading major works in Michel Foucault and applications of his work in the field of Education. CI 529 Foucault in Education (3) The purposes of this course are twofold: 1) to read and discuss in depth the work of Michel Foucault and 2) to consider how Foucault's ideas may inform and be informed by theories and practices in education. Foucault is arguably one of the pre-eminent Western social theorists of the 20th century. Researchers and theorists working from post-structural, critical and socio-cultural perspectives frequently turn to Foucault's concepts of power, discipline, and subjectivity as powerful analytic lenses for analyzing the daily lives and practices of students and teachers in classrooms as well as more generally the field of Education, educational politics and policies, and educational institutions. Additionally, given the tremendous impact of Foucault's work in multiple disciplines throughout the academe, the ability to read and apply the theories of Foucault can facilitate broader reading and discussion across a variety of disciplines. In the class, students will devote approximately 2/3 of the time to reading original works by Foucault and brief commentaries on these works, and 1/3 of the time reading applications of Foucault's work by education researchers and theorists. The primary work load of the class is reading. Reading Foucault is not an easy task. Students can expect careful scaffolding of their learning through classroom discussions, a required on-line discussion forum, and frequent feedback from the instructor. Preparation for and participation in class discussions and in the building of a vibrant learning environment are required components of the class.

CI 530: Identities in Second Language Learning

3 Credits

This course investigates the ongoing collaborative construction and negotiation of race, ethnicity, gender, sexual, and social class identities in second language learning (SLL). It examines how we learn to speak our multiple selves in a new language, for example, how we learn to language race according to our prior background and the cultural practices and understandings of second language contexts. The impact of these social identities and polemics of racism, sexism, xenophobia, colonialism, homophobia, and elitism that arise when we study them are not restricted

to experiences outside the classroom, nor can they be divorced from language curriculum and pedagogy. Examining such issues in SLL can be challenging due to the belief that raising them courts controversy unnecessarily and goes against mindsets that many value, such as colorblindness, because language learning is an area that naturally welcomes and fosters integration and interaction between different groups in multicultural education. Course participants will interrogate the idea of colorblind language learning classrooms and curricula and examine how the realities of language learners' differentiated, inequitable access, treatment, and experiences in multilingual contexts challenge the field's declared values of multiculturalism in education.

CI 541: Place(s) in Education

3 Credits

In an essay about place, the anthropologist Clifford Geertz notes that "something that is a dimension of everyone's existence, the intensity of where we are, passes by anonymously and unremarked. It goes without saying." The purpose of this course is to foreground the concept of place and real places in our daily lives and academic work, particularly with respect to education (including schooling), to make sure that it does not go without saying. What is (a) place? How is it formed, bounded, made meaningful? How is it personal and social? What are its relationships with time and space? What are its relationships with experience, culture, citizenship, margins, diversity, and so many other topics? How does it shape living, especially learning and teaching in schools, and how is it shaped by these things? How do I and we fit in? And, following the feminist educational philosopher Nel Noddings, "should schools teach for an understanding and love of place or should they now offer curricula designed to transcend place?" Through a seminar format focused specifically on educational contexts, we will study place from a range of interdisciplinary perspectives and consider what these landscapes of place mean for teaching, learning, and educational research. Readings will draw from the fields of anthropology, art/s, curriculum, ecology, geography, indigenous thought, literature, philosophy, and sociology, all intersecting with education. Assignments will include citizenship in the community of this course, personal reflection about lived place(s) inside of schools and out, critical analyses of the literature on the intersections of education and place(s), and a final project focused on one aspect of how education and place(s) intersect that is of particular interest to the student. In dialogue, collaboration, the reading of each other's writings, and other activities such as a walking tour of students' most-meaningful places on campus, participants in this course will be and become citizens of the place (and its many physical, digital, and relational places) of the course. Students will exit the course with a broad understanding of the complexity of place(s) in education, including in the work of teachers and researchers.

CI 542: Girls' Cultures and Popular Cultures

3 Credits

This seminar explores educational implications in popular texts created for and by girls across time and cultures. CI (WMNST) 542 Girls' Cultures and Popular Cultures (3) The study of girls and their relationship with popular culture lies within the interdisciplinary field of Girlhood Studies which draws on established areas of Women's Studies, Children's/ Childhood studies, Cultural Studies and Educational Studies. This seminar explores girls cultures in different textual and material forms including books, toys, magazines, and new media. Students will employ feminist cultural theories to compare historical and contemporary girls cultures in relation to educational research and practice. This will

provide a framework to locate girls at the center of research and action in order for graduate students to engage in methodologies that are not simply about girls but "for" "with" and "by" girls. Key topics include the misperception of girls (popular) culture as only a contemporary phenomenon, the role of girls as consumers plus producers of culture, and recurrent issues in girls cultures such as sexualization and hyperfemininity.

Cross-listed with: WMNST 542

CI 550: Overview of Contemporary School Curriculum

3 Credits/Maximum of 999

Current school programs and options and their impact on pupils; problems in introducing new content into the curriculum.

Prerequisite: 12 credits in education and psychology or teaching experience

CI 552: The Methods Course in Teacher Education: Challenges and Opportunities

3 Credits

This course will focus on the 'methods course' in teacher education. A common feature of teacher education programs in almost any setting, methods courses are those courses teacher candidates take that address how to teach. Of course, 'how to teach' is nowhere near as simple as that would sound, and even less simple is how to teach how to teach, in a way that will actually influence how candidates will teach. Students in this course will read research on methods courses, analyze many examples at Penn State and elsewhere, and inquire together about methods course design. Students will explore: · WHY have methods courses at all? Are there things to learn about how to teach that can't be learned through field experience alone? · WHAT shall the content of methods be? Are there such things as 'general methods' or must methods courses always be content-area-specific? What shall students read and come to know in a methods course? · WHO shall teach methods courses, and who shall take them? What happens when practitioners teach methods, as opposed to university faculty? Or when we co-teach? · WHEN shall methods courses occur in the timespan of a teacher preparation program? Must they be concurrent with field experience, or should they precede it? What prerequisite knowledge or experiences matter for the success of a methods course? · WHERE shall methods courses be taught? On site in a school? At the university? Somewhere else? What about online? · HOW shall methods be taught? What course activities actually help teacher candidates learn to teach? What are appropriate uses of readings? Peer teaching? Classroom inquiry? By the end of the course, students will have articulated research-based answers to these questions. In addition, students will be able to apply the available research to existing methods courses in their own current and/or future context(s).

RECOMMENDED PREPARATIONS: This course is recommended for doctoral students whose future plans include teaching in teacher-preparation programs

CI 560: Theories of Childhood

3 Credits

The study of childhood from cultural, historical, psychological and philosophical perspectives. CI 560 Theories of Childhood (3) In this course, participants will explore the highly variable ways that childhood has been constructed and enacted across multiple cultures and

throughout history. Participants will begin by considering how notions of the nature of childhood, for example, children as innocent, as primitive, or as blank slates have functioned across history and in their memories and sense of nostalgia about childhood. Participants will expand their understanding of historic and contemporary childhoods through comparative studies of children. Participants will examine and critique normative theories of child development and will finish with an examination of contemporary child culture, including play and how changes in global culture affect children's lives. The course instructor will provide the readings for the course, as well as background information and organizing topics. The instructor creates and assigns activities and provides or oversees discussion questions to organize student thinking for a productive discussion. It is the instructor's responsibility to create an environment conducive to students' development of an open, vibrant learning community; to establish and oversee course standards; and to assist students to achieve both the course objectives and their own. There are no prerequisites for this course. Given that all participants have had a childhood and some may be parents, the memories and experiences each participant brings may be both a help and a hindrance. That is, insofar as their own childhoods or those of their children cause them to believe that they already know what childhood is, class participants need to recognize the limitations of their memories and experiences. The diversity of childhoods that will be represented across the members of the course is a considerable resource for participants to develop an ever-broader understanding of the cultural and historical nature of childhood.

CI 565: Writing Research Articles in Curriculum and Instruction

3 Credits

Graduate course on revising a written product for publication in a peer-reviewed research journal in curriculum and instruction or related fields. CI 565 Writing Research Articles in Curriculum and Instruction (3) In this course, students will prepare a research article for publication. Beginning with a course paper, conference paper, comps paper, thesis, pilot study, dissertation, or another pre-existing draft, writers will learn to frame, revise, and edit a scholarly article for submission to a journal. To do this, students will spend time addressing the genres and conventions of writing about education research for an academic audience, focusing on particular subfields in curriculum and instruction. Students will read and analyze published research in curriculum and instruction, study principles of rhetoric and style, practice collaboration and peer review, and engage in intensive revision and editing. Students will gain skill in dealing with the emotions of writing, work habits, giving and receiving feedback, and motivation. They will also work through concerns like organization, exposition and elaboration, and argument as well as matters of correctness and grammar. Students will consider the variations in epistemology, genre, and conventions of argument and of style for the wide range of subfields in curriculum and instruction as well as across education subfields. This includes attention to historical and contemporary divergences between fields and ways of bridging those as needed for dissemination research. Major assignments include analyses of target journals and representative articles, experiments in scheduling and writing habits, and weekly challenges in revising. In addition, students will work in intensive writing groups across the length of the term. Each student will receive extensive feedback on a draft in progress toward the goal of having a manuscript suitable for submission by course end.

CI 570: Language Policy for Multilinguals: Language, Culture, Socioemotional, and Psychological Implications

3 Credits

In this course, students will develop a deeper understanding of the historical and contemporary forces that have shaped language education program policies; evaluate how policies have influenced, and continue to influence, teacher education programs and educational and social outcomes of multilingual learners. Topics covered include research on the requisite knowledge educators must have to engage in practices that promote positive outcomes for multilingual learners; a historical overview of language policies and research foci; empirical evidence on the effectiveness of different language instruction education programs; contemporary issues of testing and validity, as well as reclassification and tracking; and contemporary debates (e.g., translanguaging and codeswitching; dual language for whom?).

CI 580: Media Literacy, Language, and Literacy in Schools

3 Credits

Theories of media literacy, issues of non-print technology in language and literacy.

Prerequisite: LL ED480

Cross-listed with: LLED 580

CI 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

CI 595: Internship in Curriculum, Supervision, or Instruction

1-6 Credits/Maximum of 6

Internship in schools or other educational settings under supervision of graduate faculty in student's area of specialization.

Prerequisite: approval by program head and at least 15 graduate-level credits in Education

CI 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects including nonthesis research, supervised on an individual basis and which fall outside the scope of formal courses.

CI 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered frequently.

CI 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

CI 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

CI 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Teaching experience in Curriculum and Instruction undergraduate faculty supervision.

Prerequisite: admission to C&I doctoral program and program head permission

CI 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

CI 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

CI 810: Adolescent Development and Learning

3 Credits

This course applies psychological principles of adolescent development and provides a critical examination of factors (gender, socioeconomic status (SES), race, ethnicity, culture, disability, and language) that have an impact on physical, cognitive, social, emotional, behavioral, and moral developmental outcomes. This course will engage learners with the practical and theoretical issues regarding adolescent development and learning in secondary education settings.

CI 811: Science and Mathematics Teaching in Secondary Schools I

3 Credits

CI 811 is the first of two sequenced methods courses for science and mathematics teachers who are pursuing certification to teach in grades 7-12 and are post-baccalaureate. The course emphasizes contemporary theory and practice informing science and mathematics education in public secondary school classroom settings. Students will deepen their understandings of theories of how people learn and apply that knowledge toward developing ambitious mathematics or science teaching practices to serve diverse learners. Students also develop familiarity with and understanding of current state and national content standards that guide mathematics and science education. Students will engage in activities intended to develop their critical consciousness around diversity, equity, inclusion, and belonging. CI 811 focuses on teaching as a relational activity, including asset-based approaches to teaching, as well as developing teaching practices that are equity focused, anti-racist, and transformative for students who are historically marginalized in the U.S. CI 811 is scheduled concurrently with a supervised field experience in a middle or secondary school, where students have the opportunity to apply and evaluate their developing instructional skills. CI 811 and the concurrent field experience are designed specifically to provide strong connections between educational theory and teaching practice.

Corequisite: CI 895 Recommended Preparation: Admission into PSU Teacher-in-Residence Certification Program

CI 812: Science and Mathematics Teaching in Secondary Schools II

3 Credits

CI 812 is the second of two sequenced teaching methods courses for science and mathematics teachers who are enrolled in the PSU Teachers-in-Residence program and are pursuing post-baccalaureate Pennsylvania teacher certification for grades 7-12. It is meant for grades 7-12 teachers who hold emergency PA teaching certification and are currently teaching in a middle or high school in PA. It is a part of an 18-credit program that will lead to permanent Pennsylvania teaching certification for grades 7-12. The course builds on prior coursework including CI 811 and continues to emphasize contemporary educational theory and teaching practice informing science and mathematics education in secondary public school classroom settings. The course extends the equity focused and anti-racist teaching practices from 811 to prepare students to support a diverse population of students, through asset-based approaches to teaching. Having worked on the development of critical consciousness in prior coursework, they will begin more deeply engaging with research-based teaching practices through structured experiences with students in school. They will also build on their lesson design work to organize larger units of instructional practice through analysis and critique of existing materials. Finally, they will develop assessments, both formative and summative, that are informed by understandings of research-based ambitious mathematics and science teaching practices, as well as asset-based equitable pedagogies. As this course is taken concurrently with CI 895 (field experiences), there will be a natural flow of work completed as a part of CI 812 being implemented in the students' home classrooms. CI 812 is designed specifically to provide strong connections between educational theory and teaching practice.

Prerequisite: CI 811 Corequisite: CI 895 Recommended Preparation: Admission into PSU Teacher-in-Residence Certification Program

CI 895: Internship

1-18 Credits/Maximum of 18

Supervised, professionally oriented, off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

CI 896: Individual Studies

1-9 Credits/Maximum of 9

Creative projects with a professional orientation, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

Curriculum and Supervision (C-S)

C-S 551: Curriculum Design: Theory and Practice

3 Credits

Course participants explore the fundamentals of curriculum; that is, curriculum cultures, traditions, perspectives, theories, or models that have significantly affected the field of curriculum design. Participants also learn about historical and contemporary issues in the development of national, state, and local academic standards, and how these issues have shaped the design of particular curriculum programs.

Participants engage in curricular analysis of a content-specific program through examination of "what is behind the curriculum" (purpose, goal, perspectives, assumptions), "what is in the curriculum" (the nature of the content, basis for its selection, content and media structures), and "what are the experiences with the curriculum" (how curriculum may be taught, what methods may be used, how the program success may be judged, the "frame-factors") in order to outline the strengths and weaknesses of the program, and how it can be adapted to maximize its benefits and minimize its limitations for a specific institutional or educational context.

Cross-listed with: EDLDR 551

C-S 553: Issues in Curriculum

3 Credits/Maximum of 6

In-depth study of issues and trends in the understanding and practice of curriculum. C & S 553 Issues in Curriculum (3 per semester/maximum of 6) This course provides for in-depth study of issues and trends in the understanding and practices of curriculum. Readings and class activities provide students with the opportunity to examine theoretical implications for the world of practice and life in schools.

Prerequisite: formal acceptance as a doctoral student in the Curriculum and Supervision option area

C-S 555: Development of Teacher Education Programs

3 Credits

Study of the components and design of teacher education programs within the constraints of institutional, professional, and legal contexts. C-S (EDLDR) 555 Development of Teacher Education Programs (3) Enrollees study various models of teacher preparation such as professional development schools and fifth year programs. Participants also discuss various aspects of teacher education such as field experiences teaching and learning ("methods") courses, and content knowledge courses and review research in each of these areas as it relates to the initial continuing education of teachers.

Prerequisite: C I 550 or EDLDR551

C-S 557: Seminar in Curriculum Research

3 Credits

Analysis of particular curriculum studies, methods and paradigms, and the general status of current research in the general curriculum field. C & S 557 Seminar in Curriculum Research (3) This course is a foundational course that supports the diverse inquiries undertaken by doctoral students within the Department of Curriculum & Instruction and throughout the broader university community. Readings and class activities provide students with the opportunity to learn about different research epistemologies and to explore taken-for-granted assumptions about educational research in general and research design and methodology in particular.

Prerequisite: C I 400, C I 550

C-S 560: Principles of Instructional Supervision

3 Credits

Social and institutional settings for instructional supervision; functions, activities, and practices of supervision; supervisory case studies. EDLDR 560 C-S 560 Principles of Instructional Supervision (3) This course

explores themes, trends, and key ideas that influence current supervisory practices. Course content gives specific attention to supervisory practice in relation to teaching practices and to life in schools.

Prerequisite: teaching or school administrative experience; 18 credits in education, at least 5 of which are methods of teaching
Cross-listed with: EDLDR 560

C-S 562: Methods of Classroom Supervision and Coaching

3 Credits

Strategies and techniques for supervision/coaching of instruction intended to enhance teacher reflection, self-direction, and autonomy. C-S 562 Methods of Classroom Supervision and Coaching (3) This course has been designed to equip students with the knowledge, skills, and dispositions necessary to engage in a variety of supervisory processes aimed at teacher growth and renewal as well as enhanced student learning. The outcome of these supervisory activities should be the development of teachers who are more analytical about their practice and its impact on learners, are more adept at solving the complex problems of teaching practice, and are more reflective about their teaching capabilities.

Prerequisite: EDLDR 560, teaching administrative, or other professional education work experience

C-S 563: Designing Staff Development Programs

3 Credits

Designing, implementing, and evaluating effective staff development programs for personnel in educational settings. EDLDR 563 Designing Staff Development Programs (3) This course has been designed to provide students with the opportunity to develop a deep understanding of the process of professional development in education at the theoretical and practical levels as well as the ability to apply this understanding to the design, evaluation, and analysis of professional development activities and programs.

Prerequisite: EDLDR560
Cross-listed with: EDLDR 563

C-S 564: Supervision Theory

3 Credits

Critical analysis of alternative theories of instructional supervision and in-depth examination of trends and issues in supervision. C & S (EDLDR) 564 Supervision Theory (3) This course entails critical analysis of alternative theories of instructional supervision and in-depth examination of trends and issues in supervision. Students critique and contrast existing models of instruction, identify and analyze issues in supervision and conceptualize and articulate their own supervisory model.

Prerequisite: EDLDR560

C-S 565: Research in School-University Partnerships

3 Credits

A school-university partnership (SUP) is as "a living, learning community intended to close conceptual and practical separations that tend to exist between teacher education programs and the nation's schools" (NAPDS, 2021, p. 10). SUPs are well-positioned to convene community members from disparate institutional role identities as partners who learn together

through reflection and inquiry. The challenges inherent in creating learning communities that actually involve all community members has been long acknowledged in SUP work. One approach to supporting the learning of a wider range of SUP partners is to create and sustain an inquiry community that is continually engaged in the cyclical process of practitioner inquiry. C-S 565 provides one such community. In light of systemic racial discrimination and oppression, this course more specifically focuses on the use of inquiry/research in a SUP inquiry community to address issues of social justice, and concentrate on ways schools and universities can partner in the urgent and crucial work of educational equity. In this course, students (target: SUP partners from both PreK-12 schools and the university) will work within a SUP inquiry community to develop theoretical and practical understanding about practitioner inquiry, teacher education across the career-span, and diversity, equity, inclusion, and belonging (DEIB). They will engage in scholarly discussion and research related to these concepts and situated within their own unique contexts: 1. What do we mean by social justice and DEIB? 2. What is practitioner inquiry and how can it be useful to my practice as a teacher, teacher educator, and/or educational researcher addressing issues of social justice? 3. How can schools and universities partner for educational equity?

C-S 576: Research Methods in Teacher Education

3 Credits

A basis in theory, findings from research, research design, and methodologies related to teacher education.

Cross-listed with: EDPSY 576

C-S 590: Colloquium

1-3 Credits/Maximum of 4

Recommended Preparation: This course is ONLY for students admitted to the doctoral program in Curriculum and Instruction specializing in Curriculum and Supervision. Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

C-S 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

C-S 597A: **SPECIAL TOPICS**

1-9 Credits

Data Analytics (DAAN)

DAAN 501: Analytics Research and Problem Framing

3 Credits

Students in this course will explore the elements of the research process within quantitative, qualitative, and mixed methods approaches as it applies to research into data analytics and its use. The ethical principles and challenges of research will be covered including human-subject research guidelines and the Institutional Review Board approval process. Students will use these theoretical underpinnings to begin to critically review literature in the analytics domain, determine how research findings

are useful in forming their understanding of their work, and place their own research within the context of the extant literature.

Prerequisite: STAT 500

DAAN 545: Data Mining

3 Credits

Practical benefits of data mining will be presented; data warehousing, data cubes, and underlying algorithms used by data mining software.

DAAN 600: Thesis Research

1-15 Credits/Maximum of 15

Thesis Research

Prerequisite: DANN 501

DAAN 822: Data Collection and Cleaning

3 Credits

This course focuses on the tools and techniques required for collecting data and preparing them for further analysis. The presence of incorrect and inconsistent data can significantly distort the results of the analysis often negating the potential benefits of information-driven approaches. As a result a variety of research over the last decades has focused on data cleansing: computational procedures to automatically or semi-automatically identify - and, when possible, correct - errors in large data sets. The goal of this course is to explore and discuss different data collection tools and techniques in addition to learning skills for retrieving data from existing databases. To further enforce data quality and reliability this course will cover techniques for error detection and data cleaning on large databases. Students will learn the available tools and techniques for data collection including automated data collection for databases, retrieving data from available databases, data preparation and cleansing techniques, data quality and reliability and finally learn techniques to identify issues in data collection and how to clean the data.

Prerequisite: STAT 500

DAAN 825: Large-Scale Database and Warehouse

3 Credits

This course provides a broad exploration of current and emerging practices for handling large quantities of data using large-scale database systems. Data is being generated at an exponential rate and handling and analyzing such data needs highly customized tools and processes to handle data-intensive tasks. In particular, this course investigates methods to effectively design, develop, and implement the two dominant types of large-scale databases: data warehouses for dimensional data and NoSQL databases for loosely-structured data. Students will learn to design a wide variety of large database solutions, apply extract-transform-load (ETL) strategies, maintain and evolve large-scale databases, explore the fundamentals of NoSQL systems, and understand the properties of different database technologies against atomicity, consistency, isolation, and durability (ACID) properties.

DAAN 826: LARGE SCALE DATABASES FOR REAL-TIME ANALYTICS

3 Credits

This course provides an exploration of current and emerging big data solutions for handling large quantities of data in real-time. In particular,

this course investigates methods to design, develop, and implement several systems used for real-time data analysis and storage such as document databases, column-based databases, queueing systems, and real-time processing systems. Students will learn to design a wide variety of large database solutions, and how to interconnect those systems to create a lambda architecture. Using this platform, students will collect, process, store, and report real-time data.

Prerequisite: DAAN 825

DAAN 846: Network and Predictive Analytics for Socio-Technical Systems

3 Credits

The objective of this course is to provide a foundation in the principles of network and predictive analytics along with hands-on experience with statistical analysis software for studying the interrelatedness of cyber-social and cyber-technical aspects of our society as a whole that have transformed physical communities into virtual communities. Fundamental principles of network and predictive analytics, the importance of studying network structures, and how network structures can facilitate communication, coordination and cooperation will be discussed. Statistical analysis software will be used for analyzing the structure of an organization or a society as whole to detect and capture the dynamic patterns of group membership and structure, and predict threats, attacks, criminal behavior and evolution of criminal networks.

Cross-listed with: INSC 846

DAAN 862: Analytics Programming in Python

3 Credits

This course will explore the development of analytics systems and the application of best practices and established software design principles using the Python programming language and its several toolkits. Students will manipulate, analyze and visualize complex data sets and implement statistical, machine learning, information visualization, text analysis, and social network analysis techniques through popular Python toolkits to gain insight into their data.

DAAN 871: Data Visualization

3 Credits

This course provides a foundation in the principles, concepts, techniques and tools for visualizing large data sets. DAAN 871 Data Visualization (3) The course provides a foundation in the principles, concepts, techniques and tools for visualizing information in large complex data sets. Unlike scientific visualization, which focuses on the presentation of data that has a spatial or physical correspondence, data visualization focuses on mapping complex, abstract information to a physical representation. The development of effective visualization strategies is crucial for not only facilitating an understanding of large complex data sets but also for driving knowledge discovery and the decision making processes in a given domain. In this course, students will learn the key principles involved in data visualization and will explore a wide range of visualization approaches that can be applied for understanding complex data across different data types. Specifically, techniques for visualizing one-dimensional data (e.g., temporal data); two-dimensional data (e.g., geospatial data); multidimensional data (e.g., mapping relational data in n-dimensional space); hierarchies and graphs (e.g., tree structures); networks (e.g., social networks) and text (e.g., mining text and hypertext from Web) will be discussed. Emphasis will be placed on the identification of patterns, trends and differences in visualizations of

data from variety of domains (e.g., science, business, engineering, social media, etc.). In addition, students will gain hands-on experience with a variety of visualization tools including: Gephi, ManyEyes, Excel, Science of Science (Sci2), Pajek, Lattix, R, Cfinder, MapEquation, NodeXL, and/or Gapminder.

DAAN 881: Data-Driven Decision Making

3 Credits

Application & interpretation of analytics for real-life decision making. DAAN 881 Data-Driven Decision Making (3) The theory and application of several quantitative decision-making tools will be studied. The usefulness of these tools will be illustrated using projects and case studies throughout the course. Emphasis will be placed on the application of the tools and techniques and the results they generate. Finding patterns in data and appropriately grouping them are essential in the extraction of information in large datasets. This course will use Principal Component Analyses to transform highly correlated sets of data by means of orthogonal transformation. Cluster analysis will be used to properly group data when working with large datasets. When the outcomes involve categorical variables, Logistic regression techniques will be used to estimate the probabilistic values of the output. The decision space will be divided into smaller regions using Regression tree analyses. When factors are too numerous and highly collinear, Partial Least Square Regression methods will be performed. Public access datasets in the healthcare, transportation and finance industries will be used to demonstrate the applications and the limitations of these techniques.

Prerequisite: STAT 500 and DAAN 501

DAAN 888: Design and Implementation of Analytics Systems

3 Credits

Design and implement data science and analytics systems using contemporary tools and techniques.

Prerequisite: IN SC521 and DAAN 825 and DAAN 881

DAAN 897: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

Data Sciences (DS)

DS 540: Multimedia Analytics

3 Credits

This course covers all aspects of multimedia analytics including the foundations, representations, implementations, and applications of extracting patterns from images, video, audio, and related context information for the purpose of prediction, automated discovery, and decision-making. Specific topics to be covered in the course include an overview of multimedia systems, multimedia data representation and compression, image and video analysis, audio analysis, multimedia information retrieval, and advanced topics in multimedia analytics. Emphasis will be placed on the integrative approach to multimedia analytics, in which the systems can benefit from the synergy of leveraging multiple sensing modalities, including audio, image, video, text, and more. The objective of the course is to provide students with a wide

range of models and applications that are relevant to their research and development in modern multimedia analytics systems.

recommended prep: IST 510

DS 560: Principles of Causal Inference

3 Credits

The course will give students a comprehensive coverage of the theoretical underpinnings, and practice of causal inference from observational and experimental data. Topics to be covered include: pitfalls of standard machine learning algorithms when applied to observational data; causal inference in the absence of randomized control trials; causal effects and counterfactuals; eliciting causal effects from observations; the Causal Bayesian Network framework for causal inference - do-calculus, identifiability of causal effects from observations and experiments; the Potential Outcomes framework for causal inference - matching and propensity score-based methods and their advanced variants for counterfactual inference; the relationship between the Potential Outcomes and causal Bayes Networks; and learning causal models from observations and experiments. The course will give a principled treatment to confounders as well as practical approaches to cope with them. Additional topics to be covered include mediation analysis; advanced machine learning methods for causal effect estimation; causal transportability; selection bias; and meta-analysis. Finally, the course will include a laboratory component to provide students with hands-on experience with applications of causal inference to problems from several domains. Course projects will focus on applications of causal models and causal inference e.g., in science, public policy, and health. Recommended preparation for the course include basic proficiency in programming, elements of probability theory and statistics, discrete mathematics, and machine learning.

Recommended Preparations: IST 510, Probability and statistics, differential calculus, linear algebra, programming proficiency (e.g., in Python), and machine learning

Demography (DEMOG)

DEMOG 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

DEMOG 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

Early Childhood Education (ECE)

ECE 572: Issues and Trends in Early Childhood Education

3 Credits/Maximum of 9

Research, experimental programs, and emerging trends in early childhood education; relationships between educational experiences and later intellectual and emotional development.

Prerequisite: E C E452 , EDPSY400

ECE 587: Curriculum, Culture, and Child Development

3 Credits

Examines human development and cultural factors in planning, designing, and implementing curriculum and instruction in early childhood and childhood education.

Prerequisite: HD FS429

Cross-listed with: CIED 587

ECE 588: Educational Role of the Family

3 Credits

Parent-child-teacher relationships, cognitive socialization, and academic attainments; proximal/distal variables: family structure, history, processes, content, community, culture.

Prerequisite: E C E453 , HD FS418 , or SOC 315

ECE 589: Play and Early Childhood Education

3 Credits

Developmental significance of play, processes, and development; role of the adult in child's play; educational practices.

Prerequisite: HD FS429 or PSYCH415

ECE 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

ECE 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

ECE 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

Earth Sciences (EARTH)

EARTH 501: Contemporary Controversies in the Earth Sciences

3 Credits

Exploration of current areas of research in the Earth Sciences. EARTH 501 Contemporary Controversies in the Earth Sciences (3) Students will be introduced to a variety of topics from different disciplines within the Earth sciences with the aim of piquing their interest in topics of current research beyond the level found in typical secondary school or introductory college textbooks. The current topics will include subjects in which a consensus has recently been reached as well as scientific questions that are so far unanswered. Students will learn the appropriate state of the art scientific content relevant to each topic by performing basic data in order to complete the activities in each lesson. They will finally construct a plan to teach a selected topic to the audience

of their choice. This course provides an entry into the other courses in the Master's Degree Program in Earth Science Education. Students will learn scientific content by completing activities in each of six lessons that will span either the 12-week or 15-week semester. These activities will be in the form of background reading and discussion that outlines a current scientific problem or debate, the collection and manipulation of appropriate data, and the assessment of the results of this work. By doing this, students will simultaneously become familiar with the content as well as the practice of science. Students will also participate in online discussions about how to teach this content to specific secondary school audiences. They will complete a capstone project in which they will construct a teaching plan based on the topic of their choice.

EARTH 520: Plate Tectonics and People: Foundations of Solid Earth Science

3 Credits

Solid Earth geophysics and geological hazards presented within the grand unifying theory of plate tectonics. EARTH 520 Plate Tectonics and People: Foundations of Solid Earth Science (3) This course will cover current areas of research in solid Earth geophysics, especially focusing on the human population's interaction with the solid Earth system. Students will be introduced to a variety of current topics of active research within the field of solid Earth geophysics. They will learn the appropriate state of the art scientific content relevant to each topic by performing basic data analysis (e.g. collection, interpretation and assessment) using publicly available data in order to complete the activities in each lesson. They will finally construct a plan to teach a selected topic to the audience of their choice. Students will learn scientific content by completing activities in each of nine lessons that will span either the 12-week or 15-week semester. These activities will be in the form of background reading that outlines a current scientific problem or debate, the collection and manipulation of appropriate data, and the assessment of the results of this work. By doing this, students will simultaneously become familiar with the content as well as the practice of science. Students will also participate in online discussions about how to teach this content to specific secondary school audiences. They will complete a capstone project in which they will construct a teaching plan based on the topic of their choice.

EARTH 530: Earth Surface Processes in the Critical Zone

3 Credits

Introduction to Earth surface processes including weathering and soils, geomorphology, erosion and sedimentation, hydrogeology, low-temperature geochemistry and Earth systems. EARTH 530 Earth Surface Processes in the Critical Zone (3) Rapid changes in Earth's surface largely in response to human activity have led to the realization that fundamental questions remain to be answered regarding natural functioning of the Critical Zone, the thin veneer at Earth's surface where the atmosphere, lithosphere, hydrosphere and biosphere interact. To understand these processes requires a broad array of scientific expertise spanning: geology, soil science, biology, ecology, geochemistry, geomorphology and hydrology. EARTH 530 will introduce students to the basic information necessary for understanding Earth surface processes in the Critical Zone through an integration of various scientific disciplines. Those who successfully complete EARTH 530 will be able to apply their knowledge of fundamental concepts of Earth surface processes to understanding outstanding fundamental questions in Critical Zone science and how their lives are intimately linked to Critical Zone health. EARTH 530 will combine digital video, audio, simulation models, virtual field trips

to on-line data resources, text, and interactive quizzes that provide instantaneous feedback. The overarching goal of the course is to help secondary science teachers understand Earth surface processes at a level they can communicate to their students. These processes will be presented in a Critical Zone framework - the teachers and subsequent students will leave with a better knowledge of how their daily lives are impacted by natural processes, and conversely how their daily activities impact Earth's surface and the Critical Zone. Students will be required to complete weekly assignments. There are 12 lessons divided into 7 units in EARTH 530. Each unit will contain interactive exercises, links, animations, movies, and novel explanations of the basic scientific principles of Critical Zone science. Students will also be assigned four unit projects throughout the semester (Units 2-6). Projects require students to apply the principles they have learned to various scientific inquiries of Earth surface processes in the Critical Zone. A capstone Semester Project will require students to use the skills and knowledge they develop in the course to produce a learning module that they, in turn, will be able to use to teach course concepts to their own secondary school students.

EARTH 540: Essentials of Oceanography for Educators

3 Credits

Chemical and physical principles of the oceans and their interaction with the biosphere, atmosphere and the solid Earth. EARTH 540 Essentials of Oceanography for Educators (3)EARTH 540 introduces knowledge and broadens understanding of the oceans and their role in climate, coastal processes, and life within the fluid Earth. Students will gain insight into the physical and chemical processes that determine properties of the ocean and govern interactions between the ocean, atmosphere, groundwater, and the fluid/solid Earth. Topics will reinforce fundamental scientific principles such as heat transfer, chemical equilibrium, and conservation of energy. EARTH 540 will combine digital video, audio, simulation models, virtual field trips to on-line data resources, text, and interactive quizzes that provide instantaneous feedback.

EARTH 591: Individual Studies: Research Project

3 Credits

Development of a capstone project, supervised on an individual basis outside the scope of formal courses. EARTH 591 Individual Studies: Research Project (3)EARTH 591 broadens the content knowledge of students in the program, while deepening their understanding of a specific topic of their choosing. Students will gain insight into the essence and process of current scientific research by working with an academic advisor who is a member of the graduate faculty. They will practice transforming the results of their own investigations into modules that can then be taught to others. Students will design, develop, and conduct a project in consultation with an advisor. Appropriate projects are expected to combine basic scientific research and pedagogical techniques. Examples of projects could include (but of course are not limited to): development of a new curriculum appropriate for grades 7-12 based on a specific discipline in the Earth Sciences, such as meteorology; or an independent research project in a specific scientific subfield, such as a recent climate change, the results of which may then be taught to students.

Prerequisite: 24 credits in the Master's Degree program in Earth Science Education

EARTH 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

EARTH 801: Computation and Visualization in the Earth Sciences

3 Credits/Maximum of 999

Students practice data visualization and analysis using computational methods for Earth science data to build content knowledge and interpretation skills. EARTH 801 helps students to develop procedural programming skills in a programming language designed for visual artists and visualization while exploring Earth science topics. In particular, students learn and practice digital graphics capabilities in order to render Earth science concepts that are otherwise difficult to visualize due to complicated space and time scales. Both spatial and object visualization skills are key to success in the Earth sciences; students in this course will build an awareness of these skills and practice them with an eye to being able to teach them to their own secondary school students. In this course, students will interact with large, open, freely-available Earth science data sets by collecting, plotting, analyzing them using a variety of computational methods. Students will therefore be ready to teach their own secondary school students a range of Next Generation Science Standards skills involving data collecting, manipulation, analysis, and plotting. EARTH 801 students will also read and discuss current research regarding the teaching, learning, and evaluation of visualization skills in the Earth sciences, as well as exploring the theory of "multiple external representations" as applied to Earth science concepts and data sets.

Ecology (ECLGY)

ECLGY 510: Classical Ecology

2 Credits

Classical Ecology.

ECLGY 515: Advances in Ecology

3 Credits

Advances in Ecology.

ECLGY 526: Community Ecology

3 Credits

This course will focus on teaching graduate students the fundamental basis and advanced concepts in community ecology used to study and interpret patterns of biological diversity across divergent systems. Concepts and study cases presented in class will vary across different ecosystems and biomes and will include different organismal types (plants, animals, and microorganisms). Four main goals of this course are: (i) promote understanding of ecological processes responsible for the distribution and maintenance of biodiversity; (ii) provide knowledge to better interpret, critically discuss, and analyze current research articles and theories in community ecology; (iii) instruct students to better communicate their research in line with ecological principles and mechanisms; and (iv) allow students to lead discussions on papers related to broader community ecology concepts.

ECLGY 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

ECLGY 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

ECLGY 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

ECLGY 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

ECLGY 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Supervised experience in development of instructional materials, organizing and conducting lectures, laboratories, and evaluating students in Ecology- related undergraduate courses.

ECLGY 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

ECLGY 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

Economics (ECON)

ECON 500: Introduction to Mathematical Economics

3 Credits

Mathematical Economics: Applications of Mathematical Techniques to Economics.

ECON 501: Econometrics

3 Credits

Econometrics: Applications of Statistical Techniques to Economics

ECON 502: Microeconomic Analysis

3 Credits

Economic behavior under pure and imperfect competition; price and output determination in product markets; prices and employment in factor markets.

ECON 503: Macroeconomic Analysis

3 Credits

National income accounts; determination of income, employment, interest rates, and the price level; stabilization policy.

ECON 507: International Trade

3-6 Credits/Maximum of 6

Theory of international trade and investment; effect of commercial policy on trade and income distribution; multinational corporations and international trade.

ECON 510: Econometrics I

3 Credits

General linear model, multicollinearity, specification error, autocorrelation, heteroskedasticity, restricted least squares, functional form, dummy variables, limited dependent variables.

Prerequisite: ECON 501 or STAT 462 or STAT 501

ECON 512A: Empirical Methods in Economics I

1 Credits

The course will provide a foundation for students in the computational methods used to numerically solve and simulate economic models and program econometric estimators.

Prerequisite: ECON 510

ECON 512B: Empirical Methods in Economics II

2 Credits

The course will provide continued exposure to the computational methods used to numerically solve and simulate economic models and program econometric estimators.

Prerequisite: ECON 512A

ECON 517: Open Economy Macroeconomics and International Finance

3-6 Credits/Maximum of 6

The balance of payments, portfolio allocation, monetary and fiscal policy in an open economy, exchange rate regimes, selected policy issues.

ECON 521: Advanced Microeconomic Theory

3-6 Credits

Theory of consumer behavior; theory of the firm; price determination in product and factor markets; introduction to welfare economics.

ECON 522: Advanced Macroeconomic Theory

3-6 Credits

Measurement of income; theories of consumption, investment, and money holdings; static determination of income and employment; introduction to dynamic analysis.

ECON 530: Master's Scholarly Essay I

3 Credits

This course is a workshop designed to guide students through the process of conducting independent research towards successful completion of the M.A. Scholar Essay project. The course will provide students with broad instruction on research objectives such as formulating a research question, constructing an economic analysis, and writing up results for an academic audience. Emphasis will be placed on breaking the task of completing a research essay into discrete, and manageable tasks.

ECON 531: Master's Scholarly Essay II

3 Credits

This course is a workshop designed to guide students through the process of conducting independent research towards successful completion of the Master's Scholarly Essay. The course will provide students with broad instruction on research objectives such as formulating a research question, constructing an economic analysis, and writing up results for an academic audience. Emphasis will be placed on breaking the task of completing a research essay into discrete, manageable tasks.

Prerequisites:ECON 530

ECON 533: Applied and Quantitative Economics

3 Credits

This course combines the use of econometric software and real economic data sets to study actual empirical questions in economics. Topics covered include instrumental variables, panel data methods, estimation of nonlinear models, discrete choice models, regression discontinuity techniques and nonparametric method for data analysis. Each of the topics will have one or more empirical applications. The economic applications include production function estimation, returns to education, investment models, consumer demand models, and transportation modes.

ECON 534: Game Theory

3 Credits

Foundations of current research in game theory. ECON 534 Game Theory (3) This is an advanced graduate course in game theory and its applications to economics. The course content is mathematical in nature and emphasizes formal statements of key propositions and their proofs. It begins by presenting two alternative ways in which a game may be represented: the extensive (or tree) form and the strategic (or normal) form. The relationship between these two representations is studied and the key idea of a strategy is introduced. Pre-equilibrium notions of dominance, iterated dominance and rationalizability are studied. Nash's fundamental theorem on the existence of equilibrium in finite games is proved. Strategic form based refinements of Nash equilibrium, including perfect, proper and stable equilibria are considered. Extensive form based refinements, including subgame perfection and sequential equilibrium are also considered and compared. Harsanyi's conception of a game of incomplete information is introduced. Other subjects covered include repeated games and the folk theorem, bargaining, common knowledge. Additional topics of current interests may also be covered.

Prerequisite: ECON 521 or permission of program

ECON 543: Industrial Organization and Public Policy

3-6 Credits

The structure of American industry; performance and behavior; public policies toward business.

ECON 555: Research and Knowledge Transfer Methods

3 Credits

The course will provide an overview of existing guidelines published by experienced researchers in various subfields of economics (applied microeconomics, economic development, econometrics, industrial organization, international trade, macroeconomics, and microeconomic theory) on the topics of developing research ideas, writing papers for publication in refereed economic journals and presenting research findings in conferences (shorter presentations) and seminars (longer presentations). Models of successful writing in recent top economic publications will be discussed. Each student will then have an opportunity to apply these guidelines and practice their writing and presentation skills based on their original research. Presentations of research will be discussed with peers and research ideas will be tested within and across subfields of economics, thus preparing students for the demands of academic research exchange and academic publication in economics.

ECON 558: Development of Monetary Theory

3 Credits

Classical and neoclassical quantity theories of money and contemporary criticism; Keynesian monetary theory and its critics.

ECON 559: Current Monetary Theory and Policy

3 Credits

Post-Keynesian reformulation of quantity and Keynesian theories of money; liquidity and general equilibrium approaches; current issues in theory and policy.

ECON 570: Development Economics

3-6 Credits/Maximum of 6

Resources and institutions; quantitative measures; theories of economic growth in developing areas; developmental policies.

ECON 589: Seminar in Econometric Theory

3 Credits

Theories and methods relevant to the application of statistical methods to economics.

Prerequisite: ECON 510

ECON 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

ECON 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

ECON 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

ECON 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

ECON 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

ECON 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

Ecosystem Management (EMGT)

EMGT 810: Ecosystem Monitoring

3 Credits

This course provides students with an overview of ecosystem monitoring methods and analyses. Students completing the course will have the ability to apply a quantitative approach to the monitoring of ecosystems. Students will learn about monitoring planning, various sampling designs, and specific measurement methods used to accomplish particular monitoring objectives associated with ecosystem management. Students will be able to apply specific sampling, measurement, and data analysis methods for monitoring vegetation, wildlife, water quantity and quality, and soils, and they will have a statistical foundation for evaluating the various types of data that are collected. Specifically, students will be able to calculate reliability measures, trends, and indicators of ecosystem change, and apply hypothesis testing to these measures to determine their statistical significance. Specific sampling designs will be presented, such as simple random sampling, stratified random sampling, systematic sampling, and cluster sampling.

Prerequisite: STAT 500

EMGT 820: Environmental Law and Policy

3 Credits

This course provides a broad exploration of the basic legal principles, regimes, and issues related to environmental protection and natural resource management. Part 1 of the course gives students an overview of how the U.S. legal system works and relevant principles of constitutional and common law. Part 1 also reviews the fundamentals of environmental law and policy. After building this foundation, part 2 of the course focuses primarily on federal statutes, including the National Environmental Policy

Act, the Clean Water Act, the Endangered Species Act, Superfund, and the Clean Air Act. Part 3 uses case studies to illustrate how these laws fit together, and how they also relate to state and international issues. In addition to learning about foundational legal principles, students will learn the core principles of environmental law and regulation, and how they are changing over time. They will also better understand how federal, state, and even international environmental laws and policies fit together through the use of case studies to help illustrate key points.

EMGT 830: Ecosystem Management, Planning, and Economics

3 Credits

Making decisions as an ecosystem manager requires knowledge of economics, planning, and finance. The course provides students with a solid understanding of the key finance, planning, and economic principles needed to manage a variety natural resources and ecosystems. The first part of the course discusses cost benefit analysis from a financial perspective. Cost benefit analysis is fundamental to making decisions in ecosystem management. The module covers topics such as time value of money, discounting, inflation, risk, appraisal, and taxes, and culminates in understanding the criteria to make investment decisions with limited budgets. The second part provides students with an understanding of planning processes and tools for developing management plans for natural resources systems. This part focuses on the unique aspects of managing ecosystems, including biodiversity management and dealing with multiple stakeholders and multiple competing objectives. Students are given an overview of the use of models and decision support systems for aiding in the exploration and evaluation of large numbers of management alternatives within complex social and biological systems. The third part provides an overview of ecosystem economic concepts and principles in a market economy. Importantly, it discusses the common issue of markets not working (failures) especially in natural resources and ecosystems. This last part of the course begins by discussing how the market should work and the critical importance of well-defined property rights. Then market failures such as pollution and other externalities are discussed. In this context it is important to value many of the non-market goods and services, which is the next topic discussed. Innovative valuation methods of ecosystem benefits such as recreation and biodiversity are described. Finally, a series of applications and case studies of various ecosystem resources including carbon pricing, bioenergy, water quality, and food is provided.

EMGT 894: Capstone Experience

1-18 Credits/Maximum of 18

Supervised, professionally oriented student activities that constitute the culminating experience for the program.

Prerequisite: STAT 500, MANGT 510, LEAD 555; OLEAD 409; OLEAD 410; OLEAD 411, OLEAD 464, OLEAD 465; CAS 404, GEOG 482, EMGT 810
CONCURRENT: EMGT 820, EMGT 830

Education (EDUC)

EDUC 560: Classroom Management

3 Credits

Analysis of teaching styles, classroom behavior and interaction, organization and correlation of classroom activities and subject areas. (Requires practical application in an actual teaching situation.)

EDUC 561: Theoretical Foundations of Literacy

3 Credits

The primary goals for this course are to (1) examine the theoretical paradigms that inform the field of literacy education, including philosophical, cognitive, sociocultural, critical literacy, and multimodal/digital literacies and (2) to assist participants in becoming more aware of sociocultural, diversity, gender, and identity in relationship to literacy and schooling. Throughout the course, participants will examine the complexity of literacy to become aware of how to situate one's own literacy practice and experience in multiple contexts. Participants become reacquainted with mainstream theories and explore those of critical theorists who challenge traditional perspectives that have often marginalized race, class, and linguistic variety in learning and in literacy development.

Prerequisite: EDUC 477

EDUC 572: Comparative Education: World Perspectives

3 Credits

An evaluative comparison of American education with Western and non-Western educational systems.

EDUC 582: Spirituality and Culture in Health and Education Professions

3 Credits

This course focuses on the cultural aspects of spirituality and its place in the health and education professions. EDUC (HLHED) 582 Spirituality and Culture in Health and Education Professions (3) This course will focus on the examination of the place of the cultural aspects of spirituality and its place in the education and health professions and its implications for culturally responsive education and/or health care in a multicultural society. In particular the goals of the course are as follows: 1) To clarify the difference between spirituality and religion and to understand how spirituality is currently being examined in the fields of adult education, medical education and the health professions. 2) To examine how culture informs spirituality generally, and more specifically, to examine how culture relates to one's own spiritual development and overall health in the world. 3) To develop a sense of how people construct knowledge through image and symbol, which for many people, maps to their spirituality and culture, as they make new and deeper meaning of their own lives. 4) To begin to consider WHEN and HOW one might appropriately draw on one's own spirituality and that of participants in adult and higher educational practices and health care settings to increase cultural understanding and/or responsiveness to patient needs and when such discussion might seem to impose a spiritual or religious agenda. 5) To examine the connections among spirituality, culture, some complementary and alternative medicine modalities and overall holistic health and education.

Cross-listed with: HLHED 582

EDUC 586: Educational Research Designs

3 Credits

Focuses on methods of research in educational settings to help participants become informed consumers of the educational research literature. EDUC 586 Educational Research Designs (3) This course focuses on methods of research appropriate in educational settings to help participants become informed consumers of the educational

research literature. Throughout the course participants will 1) identify an appropriate research problem and justify the importance for investigation; 2) identify and classify the types of variables used in research; 3) utilize electronic search and communication tools; 4) critically examine various research designs and their practical applications; 5) interpret analysis of data using statistical treatments; 6) describe strengths and weaknesses in research designs; 7) critique research studies; 8) describe PSU requirements for conducting research with human subjects; and 9) develop a writing style consistent with scientific/research work with emphasis on objectivity and utilizing appropriate APA style. The key assessment for the course is a critique of a published research article. Instructors will also include assessments such as: midterm or final examinations, quizzes, class presentations, online activities or discussions, research projects, research proposals, dialogue journals, research problem descriptions, article analyses, or class participation.

Prerequisite: EDUC 539 ; or TRDEV460

EDUC 587: Master's Project

3 Credits

The development of an original master's project (paper, essay, production, practicum) supervised and judged by an appropriate faculty committee.

EDUC 589: Problems in Urban Education

3 Credits

Independent study of selected topics related to urban education.

EDUC 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

EDUC 591: Education Seminar

1-6 Credits/Maximum of 6

The capstone seminar course for the M.Ed. degree requiring an appropriate scholarly term paper. EDUC 591 Education Seminar (6) This performance-based course is intended to serve as a culminating or capstone experience for students enrolled in the Master of Education degree program in Teaching and Curriculum. A constructivist seminar format, augmented by significant readings, will be used to facilitate in-depth discussions of important, timely, and controversial issues in education. Students will be asked to reflect upon all previous course work toward the degree as a foundation for analyzing the past, evaluating the present, and speculating about the likely future of the numerous issues that collectively constitute the education arena. Students will be expected to demonstrate their ability to analyze and synthesize material through the guiding of, and participation in, class discussions of the readings, through satisfactory completion of in-class assignments, and through the completion of a major scholarly paper and a corresponding class presentation that both focus on the same aspect of an educational theme.

Prerequisite: EDUC 506 , EDUC 586 , and completion of 27 credits in the Teaching and Curriculum program or approval of program

EDUC 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

EDUC 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

EDUC 801: Global Trends in Education Culture

3 Credits

This course provides a survey of major trends in the field of comparative and international education in the last half of the 20th century. The course presents problems and issues that are of global concern in the 21st century and provides students with readings and databases that will allow them to make their own comparisons. Students will be given an overview of international organizations and the frameworks in which important contemporary education trends and issues are discussed around the world. Finally, potential future solutions will be explored.

EDUC 802: Educational Research Design

3 Credits

This course provides students with an overview of the skills necessary to design, implement, and assess research studies. Students learn the declarative, conceptual, and procedural knowledge needed for successful preparation for the conduct of research investigations. This introduction includes elements of qualitative, quantitative, and mixed methods research. After course completion, students will have the knowledge and skills necessary to evaluate published research reports, apply research methods to contextualized problems, and initiate conduct of applied research projects.

EDUC 804: Program Evaluation

3 Credits

This course gives students an overview of the fundamentals of reading, evaluating, and conducting evaluations of programs in educational settings. This course will cover theories and methods in program evaluation, ask students to analyze multiple examples of program evaluations in the real-world, and provide students with the opportunity to conceptualize and carry out a program evaluation of their choosing. Through these activities, this course will emphasize both best practices and practical considerations in program evaluation. Students will be asked to engage in the cyclical process of evaluation design, including developing evaluation questions, formulating an assessment plan, gathering quantitative and qualitative data and analyzing results, and formulating recommendations. Students will likewise be asked to critically evaluate each of these program evaluation components when reading and making decisions based on program evaluation reports. As an outcome of this course, students will be able to design a logic model, based on program features, develop an assessment plan, carry out the assessment plan, and compose a program evaluation report, including data-based recommendations for program improvement. In addition to these applied components of evaluation conceptualization and execution, the course will also ask students to adopt a critical lens on program evaluation, including grappling with foundational questions like: what is

the role of the evaluator in relation to a program and the community it serves?, what is the purpose of program evaluation and who benefits?, whose perspectives are incorporated into determining program quality and whose perspectives are excluded?, and who defines program quality?

EDUC 805: Curriculum Foundations

3 Credits

This course provides a comprehensive overview of the philosophical, historical, psychological, and social foundations that affect the school curriculum. The course calls attention to the global and multicultural perspective in education. It involves the study of the implications and applications of these curricular foundations in the form of issues and theoretical trends that shape the field of curriculum. Participation in the course activities allows candidates to identify and analyze their personal values, beliefs, and perspectives, as well as theories and research which shape their own professional practice as educators within diverse educational settings with children. By the end of the course, participants will be able to 1) develop and demonstrate understanding of how major foundations (disciplines) shape the curriculum of schooling, including philosophy, history, politics/policy, social psychology, and cultural studies; 2) consider and critique selected educational issues, both past and present, examining how they are anchored in and influenced by the foundations of curriculum; 3) investigate how social, economic, cultural, and political/policy debates and representations in the public sphere help to shape the foundations of curriculum; 4) engage in critical inquiry regarding the future roles of teachers, students, and other stakeholders in the learning community and society at large, and exercise the faculty of imagination as a means of thinking "outside the box" for educational purposes; 5) demonstrate professional scholarly attitudes, skills, and dispositions, including critical analysis and constructive use of questioning; scholarly use of research; dedication to continuous learning; positive group interaction and participatory collaboration; and reflective envisioning and enacting of curricular reform; 6) examine issues of race/ethnicity, linguistic variation, social class, gender, and sexual orientation and their relationships to the curriculum and schooling; and 7) demonstrate a professional scholarly writing style with a practical focus sharpened by theoretical awareness, using the APA Writing Manual as a style guide.

Prerequisites: EDUC 820

EDUC 806: Curriculum Development and Instructional Design

3 Credits

The course focuses on an examination of theory, issues, problems, organization, and application of instructional design for teachers in planning and developing a curriculum. The course presents examples of effective strategies including concept-based curricula, backward design, interdisciplinary approaches, integrated curricula (curriculum mapping), assessment, and reporting techniques.

Prerequisites: EDUC 805

EDUC 810: Quantitative Data Analysis Workshop

3 Credits

This course is designed for professional master's and doctoral students with a desire to increase their conceptual understanding of basic statistics and their proficiency with analytic techniques. In this hands-on workshop class, students are provided a conceptual review of quantitative statistical analysis. Hands-on activities and practice with

provided datasets allow students to learn techniques and interpretation of conducted analysis. Through this course students become more comfortable with analyzing quantitative datasets. Topics include teacher-directed review, modeled analyses, and guided practice. Participants will practice analyses and interpretation with provided example data sets. Students exit the course with a set of models to reference in their future work. Students may use personal datasets for many assignments.

Recommended Preparation: Students who enroll should be familiar with quantitative research traditions including effective research questions, data collection methods, and analytic approaches.

EDUC 811: Qualitative Data Analysis and Design

3 Credits

This course for professional master's and doctoral students focuses on the development of qualitative methods and analytic skills. Through course readings and the engagement of qualitative research techniques, course participants will situate and assess qualitative research studies within a broader research context, develop the ability to articulate a coherent research design, gain experience in foundational qualitative methods and analysis, be able to discern what questions are appropriate to qualitative research, and synthesize and write up results of data analysis.

Recommended Preparation: Students who enroll should identify different qualitative traditions, how these traditions affect the design, questions, collection methods, and analysis. Students should research questions and articulate a conceptual framework.

EDUC 815: Foundations of Education Research

3 Credits

While researchers working in the natural sciences typically share a common set of assumptions concerning their object of study, appropriate methods for investigating that object, and explanatory principles and concepts, the social and human sciences, including education, do not have this unity. Instead, a range of positions that developed in philosophy, primarily through the Nineteenth and Twentieth Centuries, have led to very different, sometimes incongruous orientations to research involving human phenomena. These include Post-Positivism, Interpretivism, the Critical Tradition, Post-Structuralism, and Pragmatism. Although the beliefs, concerns, and priorities underlying these orientations are not always made explicit by researchers, they each offer specific views concerning how knowledge is produced and how that knowledge can best be put to use in the service of humankind. This course engages with these traditions in order to identify the assumptions and commitments underlying them, to appreciate the research that has emerged from each perspective, and to understand what each has to offer education professionals.

EDUC 820: Learning Theory for the Classroom

3 Credits

This course is an application of learning theories from psychological, sociological, and physiological disciplines to educational settings for children and adolescents. At the conclusion of the course, participants will be able to 1) analyze the educational implications of cognitive, language, personal, and social/emotional development; 2) describe and distinguish among major learning theories from biological, psychological, and sociological disciplines; 3) employ knowledge of learning theories to analyze learning strategies, strengths, and needs; 4) apply learning

theories to optimize learning for all students that complements their cultural background, race, gender, ethnicity, socioeconomic status, or special needs; and 5) analyze through a theoretical lens the impact on student learning of current educational issues and trends.

Prerequisite: admission to program

EDUC 839: Educational Assessment

3 Credits

This course will prepare students with the knowledge and skills necessary to monitor, assess, and report student achievement.

Prerequisites: EDUC 820

EDUC 862: Literacy Assessment and Evaluation

3 Credits

This is a required course in the M.Ed. in Literacy Education graduate degree and reading specialist certification programs. The course is designed to familiarize participants with (1) factors related to learners who exhibit difficulty with literacy learning; (2) appropriate selection of valid, reliable, fair, and appropriate print and digital assessment tools to evaluate literacy achievement; (3) proper techniques for administering, scoring, and interpreting formal and informal literacy assessments; (4) procedures for analyzing findings, summarizing results, and advocating for appropriate literacy practices and recommendations that meet the diverse needs of K-12 learners.

Prerequisite: EDUC 561

EDUC 863: Literacy Methods

3 Credits

This course examines the literacy curriculum and teaching practices in various real world contexts to support the diverse needs of K-12 learners. Graduate students review and apply current literacy research to inform instruction within the context of their individual classrooms. Students also employ a multiliteracies framework in their lessons as they locate digital resources and tools to model critical viewing, representing, and thinking for their K-12 learners. Students enrolled in EDUC 863: Literacy Methods plan, adapt, and implement innovative instructional approaches that will support their professional practice and future role as K-12 literacy educators and reading/literacy specialists.

Prerequisite: EDUC 862

EDUC 864: Literacy Clinic

3 Credits

This capstone course for the Master of Education in Literacy Education with the Reading Specialist certification program is designed to address the major theories and empirical research that addresses the cognitive, linguistic, and sociocultural foundations of literacy development, processes, and components, including word recognition, language comprehension, strategic knowledge, critical literacy, and interdisciplinary connections. To demonstrate mastery of these concepts, students engage in an action research case study project in which they design, develop, and implement within their respective curriculum to meet the needs of K-12 learners who are experiencing difficulties with literacy. Through this case study, students demonstrate and apply pedagogical and professional knowledge, skills, and dispositions. Students select a

variety of appropriate texts, consider multimodalities, determine learners' backgrounds and interests, and administer appropriate assessments to evaluate and monitor progress. Students also have the opportunity to further enhance their ability to collaborate with professional colleagues, interact with families, and demonstrate leadership in literacy education.

Prerequisite: EDUC 863

EDUC 865: Literacy Leadership

3 Credits

EDUC 865 Literacy Leadership is a required course in the Master of Education in Literacy Education and Reading Specialist certification program that is designed to prepare students to assume the role of literacy leader within a school or school district. This role includes the implementation, management, and evaluation of the literacy program. The course allows students to connect theory to the development of effective literacy programs and intervention frameworks, and to understand the interrelated nature of literacy policy, curriculum, assessment, and instruction. Throughout the course, students develop dispositions that allow them to work collaboratively alongside classroom teachers, district officials, and other professionals as they develop curriculum, determine appropriate assessments, conduct professional learning workshops, and evaluate program effectiveness.

Prerequisite: LLED 445, EDUC 863

EDUC 894: Capstone Experience

1-18 Credits/Maximum of 18

EDUC 894 is a practicum research experience for the Doctor of Education program (D.Ed.); as such, the course expects the student to research and critically analyze a topic aligned with the student's career interests. The course covers all phases of the research process from identifying problems of practice, to reviewing literature, identifying study methods and analytical techniques, and scholarly writing of research papers. Students in a D.Ed. degree program must communicate a high level of knowledge of the subject based upon their development of research questions, gathering of sources, and completion of a high-quality scholarly paper that integrates their knowledge. This course provides the student an opportunity to apply knowledge, concepts, and theories to investigate a problem of practice. The overall goals of this research practicum are to provide students with a supervised opportunity to participate in the process of conceptualizing, implementing, and analyzing, and/or writing research studies directed towards problems of practice. Practicum experiences may encompass early, mid, and late phases of research activity.

EDUC 895: Internship

1-6 Credits/Maximum of 6

Supervised, professionally oriented, off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

Education Policy & Leadership (EPL)

EPL 501: Proseminar in Education Policy and Leadership

3 Credits

This course familiarizes students to three topics that prepare them for future coursework and doctoral research. Students will gain foundational knowledge about educational systems and contemporary educational issues; leadership theory and practice; and the socialization, milestones, research paradigms, and interdisciplinary perspectives associated with doctoral study in education policy and leadership. This course is designed to meet the University's SARI requirements for first-year graduate students.

EPL 502: Educational Policy and Politics

3 Credits

This course will familiarize students with the role of politics and public policy in K-12 and higher education. The course will examine policy models and frameworks and their application to current policy and leadership issues in education with attention to efforts to improve education and reduce educational inequality.

EPL 503: Equity and Diversity in Education Policy and Leadership

3 Credits

This course will examine policy and programs in education and related institutions through the lens of diversity, equity, inclusion and belonging with the specific goal of building skills in ethical leadership. Students will be challenged to examine prior knowledge and experience about socially constructed concepts of identity that are associated with power and oppression including race, gender, sexuality and dis/ability. Building from individual understandings of bias and privilege, this course immerses students in scholarship focused on structural inequities that are embedded within policy and programs including racism, sexism, classism, homophobia, and ableism. Focus is on an intersectional approach to studying educational structures from PK3 through university in the US as well as internationally.

EPL 504: Research Design in Education Policy and Leadership

3 Credits

This course introduces students to research design in the social sciences as it applies to education policy and leadership. Students will consider the strengths and weaknesses of various research designs that education policy and leadership researchers often use to collect and analyze evidence. They will also gain the skills needed to begin designing and conducting research in this area.

EPL 594: Research Topics

1-18 Credits/Maximum of 18

Supervised student activities on research projects identified on an individual or small-group basis.

EPL 595: Internship

1-18 Credits/Maximum of 18

Supervised, research-oriented, off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

EPL 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

EPL 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

EPL 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

EPL 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

EPL 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 9

Supervised experience in teaching and orientation to other selected aspects of the profession at The Pennsylvania State University.

EPL 610: Thesis Research Off-Campus

1-9 Credits/Maximum of 999

No description

EPL 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

Education, Development and Community Engagement (EDCE)

EDCE 501: Foundations of Education, Development, and Community Engagement

3 Credits

Historical development, social and philosophical foundations, and current status in relation to the total vocational-technical education program.

EDCE 505: Leadership Development

3 Credits

Exploration, understanding, and application of leadership roles, strategies, and principles in group and community settings.

Cross-listed with: CEDEV 505

EDCE 508: Administration and Supervision of Education, Development, and Community Engagement

3 Credits/Maximum of 3

Basics of vocational funding, supervision, leadership, and management for agricultural education.

EDCE 509: Contemporary Research in Education, Development and Community Engagement

1-6 Credits/Maximum of 6

Analysis of contemporary research issues in agricultural education and extension education through lecture, review of literature, discussion, speakers, and active participation.

EDCE 511: Youth Leadership Development

3 Credits

This course will address youth leadership development theories and emphasize formal and nonformal youth programs in agricultural and life sciences. AEE 511 AEE 511 Youth Leadership Development in the Agricultural and Life Sciences (3) The course will provide learners with an understanding of how adolescents develop and emerge as leaders in their families, schools, organizations, and communities. The overall objective for this course is to provide future and current leaders of youth organizations in the agricultural, natural resource, and/or life sciences the knowledge, skills, and experiences to develop and enhance the leadership skills and behaviors of the youth in their organizations. This will be accomplished through a variety of educational methods and techniques. Exposure to theories of youth leadership development will be shared within the context of adolescent development, group dynamics, and opportunities for growth and self-development. A variety of youth organizations and their respective leadership based programs, curricula, and philosophies will be shared and analyzed. Assignments and evaluative-based activities will focus on investigating and comparing youth organizations, analyzing leadership-based resources, analyzing youth/adolescent development theory, and developing a proposal to secure extramural funding to support youth leadership development.

EDCE 512: Decolonial Methods for Interdisciplinary Research

3 Credits

This course surveys contemporary scholarship in multiple disciplines to provide an overview of decolonial research methods and analytical frameworks. Each week, the readings will engage a different topic related to historical and contemporary ways of thinking about land, personhood, and power. Intended for students who are interested in initiating their own research projects in the future, the course is structured to enable students with little prior knowledge of archives or research methods to plan, begin, document, and revise an original project. Combining the study of theoretical readings with weekly research and reflection, students will develop critical tools for thinking, speaking, and writing about colonialism at the University and in a subject area of their choice.

Theories are enabling, dynamic, and helpful tools for approaching texts, objects, situations, places, narratives. In this course, they will encounter things both familiar and unfamiliar in ways that unsettle not only their expectations but also their presumed relationship to what they know, where they are, and what might happen next.

Recommended Preparations: Students should have taken at least one research methods course.

Cross-listed with: AFR 512

EDCE 515: Engagement Through Outreach Scholarship in Higher Education

3 Credits

To develop an understanding of outreach scholarship as a nonformal educational system and its relationship to relevant social systems. AEE 515 AEE 515. Engagement through Outreach Scholarship in Higher Education (3) Through this course, students will develop an understanding of outreach scholarship as a non-formal educational system and its relationship to relevant domestic and international social systems. Students will explore the historical and legislative history of how higher education evolved. Drawing from both contemporary as well as historical resources, students will understand the "land-grant" philosophy and outreach scholarship in higher education in order to define an engaged university. Using their definitions, students then critique outreach scholarship as it is carried out through specific institutions of higher education, both in the United States and around the world. Alternative institutional missions, organizational policies and procedures as well as organizational structures and financial arrangements will be explored to demonstrate how distinct approaches to outreach scholarship evolve and their perceived value within an institution. Within this framework, students explore today's definition for scholarship and appropriate standards for scholarly performance through outreach. Case studies, interviews, and guest lectures supplement the current and historical literature. Students carry out individual capstone projects in order to allow each of them to synthesize course content in terms of their own professional interests within an engaged university. Given the visibility of outreach scholarship in higher education today and the fluidity of its definition, implementation, and perceived value within institutions, this course reflects contemporary thought in addition to its historical underpinnings.

Prerequisite: 9 credits in education, communication, and/or social sciences

EDCE 520: Scientific Method in the Study of Education, Development and Community Engagement

1-4 Credits/Maximum of 4

Methods of procedure in investigation and experimentation in education, accompanied by a critical examination of studies made in agricultural education.

EDCE 521: Basic Applied Data Analysis in Education, Development and Community Engagement

1-4 Credits/Maximum of 4

Continuation of AEE 520; emphasis upon statistical techniques for students' individual problems.

EDCE 524: Change in Education, Development and Community Engagement

1-3 Credits/Maximum of 3

Analysis of occupational needs of students and employment prospects; organization of courses of study and other activities of teachers.

EDCE 525: Program Design and Delivery

3 Credits

This course is designed to help students develop an advanced understanding of planning, developing, delivering, and evaluating educational programs in both formal and non-formal settings. Specifically, this course focuses on programming for youth, children, and adults, in both domestic and international contexts with a special emphasis on Cooperative Extension System and outreach in the United States. Students will study the history, organization structure, and program areas in Cooperative Extension, as well as design and delivery of programs. Enrollees will explore the principles, methods, models, and practices of designing and delivering educational programs in non-formal settings. Major emphasis will be on program development/planning, implementation, delivery methods, theories of planned behavior, and evaluation.

EDCE 530: Teaching and Learning in Agricultural Science

3-4 Credits/Maximum of 4

Organization, planning and delivery of effective college teaching methods, matching/learning styles, evaluation of instruction and learning.

EDCE 535: Youth Civic Development

3 Credits

This course critically examines processes enabling youth to become members of local communities and "citizens" of nations and global societies.

EDCE 540: Youth Participation in Educational Change: Examining Youth Activism, Child Rights, and Youth Voice

3 Credits

Cross-listed with: CIED 540, EDTHP 540

EDCE 550: Program Development and Evaluation in Youth, Families and Communities

3 Credits

Examination of concepts, theories, models, and procedures relative to program development and evaluation in youth, families and communities.

Prerequisite: AEE 450 ; AEE 520

EDCE 555: Volunteer Program Management

3 Credits

The study and application of concepts and principles of volunteerism and administration relevant to volunteer program management.

EDCE 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

EDCE 595: Internship

1-18 Credits/Maximum of 18

Supervised off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

Prerequisite: prior approval of proposed assignment by instructor

EDCE 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects including non-thesis research, supervised on an individual basis and which fall outside the scope of formal courses.

EDCE 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

EDCE 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

EDCE 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

EDCE 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Involves experience in teaching undergraduate agricultural education courses under the supervision of the faculty.

EDCE 610: Thesis Research Off-Campus

1-15 Credits/Maximum of 999

No description.

EDCE 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

EDCE 840: Applied Youth Development

3 Credits

Background and current issues related to youth development programs in their application to actual youth programs in community settings.

EDCE 845: Intergenerational Programs and Practices

3 Credits

Background, intervention strategies, and issues related to developing intergenerational programs and practices aimed at addressing vital social and community issues.

Cross-listed with: CIED 845

Educational Leadership Program (EDLDR)

EDLDR 520: Sociology of Rural Schools and Communities

3 Credits/Maximum of 999

This course examines the interrelationships between rural communities and their schools. In the United States schools are the backbone of rural communities. Rural schools help to shape the local boundaries of communities and the identity of community members in a variety of both formal and informal ways. Drawing heavily from published empirical research, this course provides a solid theoretical foundation in community sociology in order to investigate the interrelationships between rural communities and rural schools. Orienting questions include: In what ways might we consider "rural" as a meaningful category in understanding both community and education? In what ways do schools shape (or reshape) the structure of communities? How do communities shape (or reshape) the structure of education? What are the challenges that confront the vitality of both rural schools and communities? How have these challenges changed over time, and what are the implications for educators, residents, and public policy makers? The course is strongly interdisciplinary, with material drawing from education, sociology and rural sociology, economics, anthropology, geography and demography.

EDLDR 521: Data Analysis for Education Research

3 Credits

This course bridges theoretical statistics coursework and practical research with real, large-scale data sets. The course emphasizes hands-on data preparation and analysis using statistical software. More specifically, the course will give an overview of national and international data resources that are available for educational researchers, survey the most widely used data analysis techniques in educational research, and use statistical software and large-scale datasets to produce useful results for educational policy research.

Cross-listed with: EDTHP 521, HIED 521

EDLDR 522: Economics of Education

3 Credits

The aim of the course is to help students view the educational system and students' educational decisions through the lens of economics. We will discuss the methods that economists commonly employ to study education and read recent empirical articles that examine the impact of educational policies and practices. At the end of the semester, we will discuss insights from the field of behavioral economics, which builds on the standard economic model to better understand decision making. This course also surveys the empirical literature on the economics of education which is organized into several broad topics, including human

capital and economic return to education, school choice and college access, and education production. Finally, the course covers a variety of econometric methods that are widely used in the economic study of education. These methods include regression models (e.g., ordinary least squares, discrete choice models, Multi-level modeling, panel data models, etc.) and commonly used techniques to deal with self-selection and causal inference (e.g., quasi-experimental methods).

Cross-listed with: EDTHP 522, HIED 522

EDLDR 524: Comparative Education Research Using Large-Scale Data

3 Credits

This course is designed to give students an overview of large-scale international assessment databases and to demonstrate how these databases can be utilized to investigate critical issues in education from a comparative perspective. A number of empirical studies using large-scale international assessment databases will be reviewed, and these analyses will be replicated via computer labs. Students will develop a good understanding of large-scale international assessment databases and will learn to apply an appropriate method to address a particular topic of interest. Students will also develop a wide range of research skills necessary to independently conduct comparative research, including but not limited to formulating a research question, conducting a literature review, analyzing empirical data, and interpreting results. Although the focus is mainly on datasets relevant to education and education policy research, the skills taught in the course are broadly transferable to other social sciences including sociology.

Recommended Preparations: Students should have taken either EDTHP 513 and EDTHP 538 or EDTHP 553 as well as EDPSY 505 or SOC 574 before enrolling in this course.

Cross-listed with: CIED 524, EDTHP 524, HIED 524

EDLDR 528: Educational Politics in the United States

3 Credits

Social and institutional forces which shape the public school system and determine national, state, and local educational policy and politics. EDLDR 528 Educational Politics in the United States (3) "Educational Politics in the United States" focuses on the social and institutional forces that shape the public school system and determine national, state, and local educational policy and politics. The rationale underlying this course is that citizens and educators, particularly those in administrative roles, need to understand the social forces that influence educational policy and politics. Until the late 1960's there was a pervasive myth that school affairs could and should be separated from the world of politics. Few people now believe that schooling can be entirely separated from politics, but many people lack an understanding of the broad, recurrent forces and competing values that ensure that schooling in pluralistic societies will be affected by political factors. This course is intended to provide a sophisticated understanding of this subject, with emphasis on the acquisition of conceptual and analytical skills that will be useful for leaders in education. Student performance is assessed through group and individual activities and projects, students' contributions to class discussions, and exams.

EDLDR 530: Leadership for Inclusive Education

3 Credits

In-depth analysis and discussion of the school leaders's role in creating and sustaining an inclusive learning environment for all.

EDLDR 531: Research on Leadership for Equity and Diversity

3 Credits

This course examines what it means to lead educational organizations in an increasingly diverse society. Specifically, this course will focus on policy, theory and practice as they relate to school leadership, and also equity and diversity as they connect personal experiences with research literature. Students from culturally, linguistically, socially, and economically diverse backgrounds account for an increasing percentage of the school-age population in the United States. This is a seminar aimed at facilitating discussion and exploration around issues related to education, equity, and diversity.

EDLDR 532: Educational Leadership Doctoral Pro-seminar

3 Credits

Preparation for doctoral studies in Educational Leadership. This course is designed as a preparation for Ph.D. studies in Educational Leadership (EDLDR). The primary purposes of this course are: to familiarize first-year Ph.D. students with graduate studies at Penn State; to identify topics, problems, and policies of importance or interest to the field of educational leadership/administration; to introduce students to EDLDR faculty members and their research; and to ensure students are aware of the programmatic requirements for successfully completing the Ph.D. degree in Educational Leadership. This course is also designed to meet the University's Scholarship and Research Integrity requirements (SARI) for all first-year graduate students.

EDLDR 533: The Politics of Local School Districts

3 Credits

Theory and practice of the politics and governance of local school districts; issues and methods in studying political decision making. EDLDR 533 The Politics of Local School Districts (3) "The Politics of Local School Districts" focuses on the theory and practice of politics in local school districts, with attention to the study of political decision-making and influence. The rationale underlying the course is that citizens and educators need to understand the social and political factors affecting school-community relations and the factors affecting the Relihood school-community conflict. Although communities vary greatly, rural, urban, and suburban communities each tend to have some distinctive features that influence the character of school-community relations and politics. At the same time, communities in general vary in the extent to which they possess characteristics that promote or inhibit the incidence and intensity of community conflict. The governance of education in local communities is heavily influenced by such factors. Consequently, educational leaders need to be knowledgeable and perceptive in this area. This course is intended to provide the knowledge and analytical skills needed for effective leadership in local school districts. Student performance is assessed through group and individual activities and projects, students' contributions to class discussions, and exams.

EDLDR 536: Federal Role in Education

3 Credits

This course examines the Federal role in education, emphasizing relationships between the Federal government and states, tribes and schools.

EDLDR 538: East Asian Education, Leadership, and Reform

3 Credits

The social and organizational characteristics of East Asian schooling, including understandings of authority, power, and leadership, and systemic school reform.

Cross-listed with: CIED 538

EDLDR 540: Technology Applications in Educational Leadership

3 Credits

Development and use of information technology applications to analyze common problems faced by educational administrators. EDLDR 540 Technology Applications in Educational Leadership (3) EDLDR 540 teaches the development and use of electronic spreadsheet models to analyze common problems faced by educational administrators. The format of the course is a computer laboratory in which students work through a series of assignments designed to introduce them to the basics of spreadsheets and then to teach a broadening range of modeling and analytical skills using progressively more complex problems. Applications are stressed through the creation of models that emphasize the organization, analysis, and presentation of data concerning such topics as salary schedules, budget preparation and analysis, expenditure control, cost projections, and data development. In conjunction with model building, a variety of analytical techniques are used, such as graphing, frequency distributions, regression, what-if tables, pivot tables, and database applications. The work in the course is individual and students move at their own pace through the assignments. New concepts and techniques are introduced and demonstrated periodically by the instructor and are then used by the students in succeeding assignments. The course accommodates widely differing ranges of abilities possessed by students taking the course. No prior computer experience is necessary. Satisfactory completion of all assignments is required for the passing R grade. The course emphasizes the development of useful information for administrative decision-making. Students should finish the course with a new or renewed confidence in their ability to deal with a problem in which some quantitative analysis is necessary, to be able to organize the available data in a logical and helpful fashion, and to use an electronic spreadsheet to develop a serviceable model to aid in the analysis.

EDLDR 542: Civil Rights and Education

3 Credits

Examination of civil rights policies and educational equity in the U.S. from the perspectives of law, social science, accountability policy. Civil Rights and Education will examine civil rights policies and educational equity in the United States from the perspectives of social science, education policy, and law. The aims of the course are to build students' understanding of the key principles of civil rights policies and the sources of contention in civil rights, and to enhance students' capacity for participating in issues of civil rights and education through project-based work. We will begin by considering what it means to have an opportunity

to learn and how it has been defined. The course will then consider legal and policy developments since the "Brown" decision that have both expanded and constrained the opportunity for certain groups of students. The course is primarily focused on national developments, but does include a focus specifically on educational opportunity in Pennsylvania. The course concludes by considering recent civil rights developments and prospects for the future. Cross Listings: EDLDR 542 will be added as a cross-listed course.

Cross-listed with: EDTHP 542

EDLDR 549: School District Improvement and Systemic Change

3 Credits

This course focuses on understanding and leading systemic district improvement efforts.

Prerequisite: EDLDR559 or EDLDR578

EDLDR 551: Curriculum Design: Theory and Practice

3 Credits

Course participants explore the fundamentals of curriculum; that is, curriculum cultures, traditions, perspectives, theories, or models that have significantly affected the field of curriculum design. Participants also learn about historical and contemporary issues in the development of national, state, and local academic standards, and how these issues have shaped the design of particular curriculum programs. Participants engage in curricular analysis of a content-specific program through examination of "what is behind the curriculum" (purpose, goal, perspectives, assumptions), "what is in the curriculum" (the nature of the content, basis for its selection, content and media structures), and "what are the experiences with the curriculum" (how curriculum may be taught, what methods may be used, how the program success may be judged, the "frame-factors") in order to outline the strengths and weaknesses of the program, and how it can be adapted to maximize its benefits and minimize its limitations for a specific institutional or educational context.

Cross-listed with: C-S 551

EDLDR 559: School Improvement

3 Credits

The course examines how educational leaders at all levels can determine, promote, support, and achieve successful school improvement. EDLDR 559 School Improvement (3) The last 20 years have witnessed unparalleled efforts to improve schools and raise student achievement. These initiatives include but are not limited to: (1) new content standards for mathematics, science, English, and social studies (2) increased requirements for high school graduation, (3) reduced class sizes, especially in the early grades, (4) new high-stakes state testing and assessment programs, and (5) the performance-based accountability requirements set by No Child Left Behind. Yet, despite all this activity and attention, significant changes in student achievement and in basic school practices have been slow at best. While there has been some improvement, success has been largely scant and spotty. The reasons for slow progress are many and complex. However, one that is receiving growing attention is the need for stronger school leaders (including teachers, principals, superintendents, and other educators) who can direct and implement changes in curriculum, instruction, and school organization. There is growing consensus in the research literature that school improvement and school leadership are largely inseparable

- that leadership is a critical element in order for schools to improve. While focusing on leadership without attending to the many other conditions that affect school effectiveness is not productive, it is clear that leadership is an important ingredient in the mix of strategies for improving schools. The course addresses three major questions: (1) What is school improvement? (2) What does it involve? (3) How do we do it? To accomplish this, the course first focuses on several general models developed for school improvement purposes. After this the focus shifts to an examination of the component pieces of school improvement, including leadership, professional development/professional learning communities, and a focus on teaching and learning (including standards, instruction, and assessments). All these are connected the larger discussion of what education leaders need to know and be able to do to strengthen instruction and raise student achievement. If leaders are to nurture better teaching and learning, they will need greater familiarity with promising instructional approaches, new curricular materials, and ways to adapt them to a particular school's circumstances.

EDLDR 560: Principles of Instructional Supervision

3 Credits

Social and institutional settings for instructional supervision; functions, activities, and practices of supervision; supervisory case studies. EDLDR 560 C-S 560 Principles of Instructional Supervision (3) This course explores themes, trends, and key ideas that influence current supervisory practices. Course content gives specific attention to supervisory practice in relation to teaching practices and to life in schools.

Prerequisite: teaching or school administrative experience; 18 credits in education, at least 5 of which are methods of teaching
Cross-listed with: C-S 560

EDLDR 563: Designing Staff Development Programs

3 Credits

Designing, implementing, and evaluating effective staff development programs for personnel in educational settings. EDLDR 563 Designing Staff Development Programs (3) This course has been designed to provide students with the opportunity to develop a deep understanding of the process of professional development in education at the theoretical and practical levels as well as the ability to apply this understanding to the design, evaluation, and analysis of professional development activities and programs.

Prerequisite: EDLDR560
Cross-listed with: C-S 563

EDLDR 567: Organizational Supervision

3 Credits

Principles and practices of supervision in schools related to instructional and support personnel. EDLDR 567 Organizational Supervision (3) "Organizational Supervision" focuses on principles and practices of supervision in schools related to instructional and support personnel. The rationale for this course is that organizational supervision is that aspect of administration that demands that the administrator focus on the instructional and non-instructional program as he/she facilitates the learning process. While the major topic in this course is the role of the administrator in the supervision of the organization, other considerations in this course are how to relate leadership, change, management, and evaluation to organizational supervision. Other topics include the nature of supervision and its place in the schools;

the organizational environment for supervision; leadership behavior and supervisory effectiveness; a contingency approach to supervision; power, authority, and conflict in supervision; teacher motivation and supervisory effectiveness; and supervision and group effectiveness.

Prerequisite: EDLDR480

EDLDR 568: The Principalship

3 Credits/Maximum of 3

Principles and practices of administration of elementary and secondary schools. EDLDR 568 The Principalship (3) The course is intended to help students gain theoretical and practical insight into what it means to be an effective principal. EDLDR 568 is not a "how to" course; that is, it makes no effort to explicitly lay out rules, procedures, "best practices," or techniques associated with being a principal. Rather, the course calls on students to read, think, write about, and discuss: What do we mean by management? By leadership? What's the difference? What social and political factors help shape the principal's organizational role and behavior? How can principals acquire and maintain power and authority? And what is the difference between these two concepts? How do different school social contexts influence principal effectiveness? What do we mean by school culture and climate? How do these relate to effectiveness? How do principals become "instructional leaders?" When should they? How should student performance be evaluated? Teacher performance? What legal issues do principals need to be aware of?

EDLDR 569: Decision Making in Educational Organizations

3 Credits/Maximum of 3

Decision making in organizational and environmental contexts; case studies of administrative problems; application of decision making models. EDLDR 569 Decision Making in Educational Organizations (3) Decision making is one of the central processes in the leadership of educational organizations. The effective decision maker is one who can define a problem, establish criteria for its successful solution, identify and evaluate alternative problem solutions and their consequences, and choose an appropriate plan of action. The course utilizes a case study approach to examine and practice decision making in an educational context. Emphasis is placed on a systematic approach to making decisions, based on theory, research, and best practice knowledge. Various models of decision making are introduced and their usefulness and appropriateness in different types of situations are examined. Working in teams, students analyze increasingly complex cases and prepare both verbal and written presentations, which are tested in general class discussion. Through active learning experiences provided by the case method, students will study significant problems of practice while developing teamwork skills in collaborative work groups.

Prerequisite: EDLDR480 , or teaching, supervisory, or administrative experience or permission of program.

EDLDR 573: Public School Finance

3 Credits/Maximum of 3

Financing of public education, including values underlying system, revenue sources and taxation, school funding formulas, equity, and school finance reform. EDLDR 573 Public School Finance (3) This course analyzes the systems and mechanisms for financing public elementary and secondary schools in the United States. It provides both an overview of basic school finance concepts and issues and an examination of Pennsylvania's system of financing schools. Throughout the course

there is a continuing effort to blend the theoretical foundations of school finance with their practical applications at state and local levels. Microcomputer models are used to explore the applications of concepts to policy and practice.

Prerequisite: EDLDR480 or teaching, administrative or supervisory experience

EDLDR 575: Ethics in Educational Leadership

3 Credits

Course explores the moral and ethical dimensions of the work of educational leaders. EDLDR 575 Ethics in Educational Leadership (3) This course will: 1) examine traditional ethics as well as alternative forms of moral development (critical theory applied to justice and feminist ethics); 2) compare and contrast one's own code of ethics with that of a professional code of ethics; 3) explore approaches to moral and ethical reasoning and to use these approaches to work through ethical dilemmas related to the practice of educational administration; and 4) have students design and present authentic ethical dilemmas providing theoretical background, appropriate questions, solutions, and reflection.

EDLDR 576: The Law and Education

3 Credits

Legal bases for education; rights and responsibilities of school board members, administrators, teachers, students, and parents; due process. EDLDR 576 The Law and Education (3) This course will provide an overview of major issues in school law. The course will focus primarily on case law including U.S. Supreme Court decisions as well as relevant state and federal lower court opinions. State legislation and administrative laws will also be considered. Topics to be covered include church/state issues, teacher and student rights, and law associated with equal educational opportunities for various groups including racial and linguistic minorities, individuals with disabilities, and women. The class will be a combination of lectures and discussions on particular legal topics based on the text and selected handouts. From time to time, the class will break up into small groups to work on in-class school law dilemmas.

Prerequisite: EDLDR480 or teaching or administrative or supervisory experience

EDLDR 577: Law and Ethics in Education

3 Credits

Course focuses on legal and ethical dimensions issues for educational leaders and their impact on best interests of the students. EDLDR 577 Law and Ethics in Education The instructor will present various paradigms of ethical decision making: justice, care, critique, community, and the ethics of the profession as well as historical and philosophical perspectives on the rights of students. Participants will then apply what they have learned to authentic legal cases involving issues such as students' free speech rights, corporal punishment, strip searching, assessment, and the right to an education. Analyses will consider questions such as: Even if an action is legal, is it ethical? and What is the "best interests of the student"?

EDLDR 578: Schools as Organizations

3 Credits

Intraorganizational relationships; administration and the school in its organizational and environmental contexts. EDLDR 578 Schools as Organizations (3) This course is planned to provide students with an orderly introduction into organizational theory and administrative leadership concepts. A primary objective behind the organization and design of this course is to firmly link theory to practice by addressing the question of what does organizational theory and research have to say that is generally important and useful to the educational practitioner/scholar. This objective is addressed through the belief that practitioners must be self-conscious about what they are doing so organizational action becomes enlightened action; that is, action that has to do with understanding and using multiple perspectives of reality. What are needed are purposeful attempts to construct or reconstitute knowledge so that events, situations and problems are confronted or engaged from multiple points of view. Decision-making and problem-solving activities thus become acts of deliberate, conscious thoughtfulness (reflective thinking, if you will) designed to reconstruct holistic knowledge in order to facilitate enlightened action. Specifically, the objectives of the course are to assist students: (1) to acquire a foundational knowledge or organizational and administrative theory; (2) to use multiple organizational theories in understanding school organizations and leadership roles in these organizations; (3) to develop a framework or schema from which to reflectively think about and develop an understanding of school organizations and problems of practice; (4) to develop a concept of leadership within school organization; (5) to develop an understanding of organizational change processes and attending issues of school change; and (6) to become familiar with organizational perspectives on schools and schooling issues and problems.

Prerequisite: EDLDR480 or teaching or administrative or supervisory experience

EDLDR 579: Financial Management for Schools

3 Credits

Financial management concepts and techniques for educators: district and school level budgeting process, hands-on budget preparation workshop, and budget management. EDLDR 579 Financial Management for Schools (3) Public schools are funded almost exclusively from revenues received from local, state, and federal taxes-public funds-and school administrators are accountable for the proper usage and stewardship of these funds. This course examines the fiscal management concepts and techniques needed by educational leaders in order to plan, control, and evaluate their operations effectively. The primary means for managing the fiscal resources of the district is through the annual budget. Administrators and other educators use the budgeting process to plan educational programs for the upcoming year, to allocate the available funds among competing programs, and to control expenditures in order not to exceed allowable limits. The primary purpose of the course is to acquaint students with the central importance of budgeting in management of schools and districts and to show how mastery of budgeting will make them more effective educational leaders. Procedures for identifying the necessary budgetary activities, as well as constraints, are discussed to provide a management context for the process. Emphasis is placed on the critical, and often neglected, step of formulating expenditure and revenue estimates to teach students how budget numbers are created. Budget modification and analysis techniques are reviewed to provide skills for changing and explaining

budget amounts. Monitoring procedures that prevent overexpenditure of budgeted funds are also discussed.

Prerequisite: EDLDR480 or teaching, administrative, or supervisory experience

EDLDR 580: The Use of Theory in Educational Administration

3 Credits

Critical analysis of current theories; problem finding and hypothesis formulation. EDLDR 580 The Use of Theory in Educational Administration (3) This course provides an introduction to problem finding in educational leadership and the development of research problems and hypotheses for conducting systematic inquiries in educational leadership. The focus will first be on the major research paradigms-the structural-functionalist, phenomenological-symbolic interactionist, and critical-constructivist-and on a overview of the kinds of approaches, questions, and problems posed in each. The emphasis will be on developing an understanding and appreciation of the different as well as complementary aspects of each of these research paradigms and the appropriate uses of each for inquiry in support of improved understanding of and practice in education. An integrated agenda of readings, lecture, group discussions and presentations, and completion of a research project will explore and emphasize the relationship and interdependence of all elements of systematic research. Activities are designed to integrate conceptual knowledge and understanding with active and collaborative participation. This course is designed to provide students with an orderly introduction to and apprenticeship in educational research. Specifically, the objectives of this course, inclusive of both semesters, are: (1) to become familiar with the major research paradigms pertinent to inquiry in educational leadership; (2) to understand the basic tenants, philosophical foundations, and epistemological beliefs of the major research paradigms; (3) to develop an understanding of the different elements involved in the educational research process; (4) to read as widely as possible in relevant literature; and, (5) to explore the research development process by identifying and developing a researchable problem statement and supporting conceptual framework

Prerequisite: EDLDR480 , 6 credits in educational leadership

EDLDR 581: Field Research in Educational Leadership

3 Credits

Field study and qualitative methods in research on educational organizations. EDLDR 581 Field Research in Educational Leadership (3) This course provides an introduction to the various research methodologies available for conducting inquiry in educational leadership across the three paradigms - structural-functionalist, phenomenological-symbolic interactionist, and critical-constructivist. Specifically, this course will focus on relationships between research questions, the theoretical/conceptual framework, and research methods but focus specifically on the methods for data collection and analysis. Part of the course will focus developing an understanding and appreciation of the different as well as complementary aspects of qualitative and quantitative research methods and the appropriate uses of each for inquiry in support of improved understanding of and practice in education. However, the majority of the course will center on the development of an understanding of the qualitative research skills needed to conduct field research. An integrated agenda of readings, lecture, group discussions and presentations, and completion of a research project will explore and emphasize the relationship and interdependence of all elements of systematic research. Activities

are designed to integrate conceptual knowledge and understanding with active and collaborative participation. This course is designed to provide students with an orderly introduction to and apprenticeship in educational research. Specifically, the objectives of this course are: (1) to become familiar with specific research designs and methods used in qualitative research; (2) to read as widely as possible in the relevant qualitative research literature; (3) to become familiar with appropriate field-based research skills for data collection; (4) to conduct field-based research investigating a specific problem related to educational practice; (5) to develop the skills necessary for qualitative data analysis; and, (6) to develop the skills needed for writing qualitative research.

Prerequisite: EDLDR480 , 6 credits in educational leadership

EDLDR 582: Reviewing and Editing Education and Policy Journals

3 Credits

Introduction to education policy journals and the review and editing process; discussion of emerging issues within the academic publishing industry.

Cross-listed with: CIED 582, EDTHP 582, HIED 582

EDLDR 584: Evaluation in Educational Organizations

3 Credits

Naturalistic and empirical evaluation methods and procedures for educational organizations. EDLDR 584 Evaluation in Educational Organizations (3) "Evaluation in Educational Organizations" examines methods and procedures for conducting effective evaluations of educational programs. It reviews naturalistic and empirical evaluation methods and procedures for educational organizations. Government demands for educational accountability, and political and social requirements for educational improvement, have increased the need for scientific and systematic evaluation of the effectiveness and efficiency of educational programs. This course provides an introduction to both qualitative and quantitative methods of program evaluation, and examines the strengths and weaknesses of alternative models and approaches for program evaluation.

Prerequisite: a course in educational administration; a course in basic statistics.

EDLDR 585: Research Design: Implications for Decisions in Higher Education

3 Credits

A capstone course on research design and analytical approaches to support decision-making in administration and policy-making. EDLDR 585 / EDTHP 585 / HIED 585 Research Design: Implications for Decisions in Higher Education (3) By the end of this course you should be able to: (1) Define and explain the following concepts/tools of social science research: The scientific method-Theory and its role, Constructs and variables, Hypotheses and relations, Experimental designs, Quasi-experimental designs and Ex post facto designs. Sampling theory and designs-Survey designs and methods, Approaches to data collection, Measurement reliability and validity, Quantitative analytical designs, and Ethical practices. (2) Apply these concepts/tools in designing a study relating to educational research. (3) Effectively critique both the theoretical bases and methods of a journal article or report of research or policy analysis. (4) Prepare a sound research proposal.

Prerequisite: EDPSY400 , EDPSY406 ; or AG 400 , R SOC573
Cross-listed with: EDTHP 585, HIED 585

EDLDR 586: Qualitative Methods in Educational Research

3 Credits

Exploration of the theoretical framework undergirding qualitative research and its attendant practices and techniques. EDLDR (EDTHP, HI ED) 586 Qualitative Methods in Educational Research (3) This course is the introductory course in the EPS qualitative research methods sequence. This is the first course in a three-course sequence departmental sequence intended to take students from basic knowledge of qualitative methods through mastery of advanced topics. This course was designed specifically to 1) orient students to the various types of qualitative methods most widely used in educational policy research and their theoretical underpinnings; 2) provide training in basic qualitative research techniques; 3) introduce students to basic research design; 4) provide systematic practice (and feedback) in evaluating qualitative research that would allow students to become sophisticated consumers of qualitative studies; 5) prepare students for the Level 11 course. The course will begin with a brief review the development of qualitative methods in related fields (anthropology, sociology, linguistics) and quickly move on to an overview of qualitative methods in education. Students must have read the material prior to class in order to take part in in-class exercises and discussions. We will focus on key issues such as validity, interpretation and representation. Students will be asked to read studies, assess the general quality of the work, and provide a critical evaluation. Students will study specific methods of qualitative field research, and most weeks we will practice and discuss a particular research technique (e.g. participant observation, focus group interviews). These practice sessions will be informed by relevant readings. Students will practice developing coding schemas as well as get a quick overview of qualitative data analysis (QDA) packages. Finally, in small groups, students will design a basic qualitative study to be presented as a final product in the course.

Cross-listed with: EDTHP 586, HIED 586

EDLDR 587: Education Policy and Politics

3 Credits

The political economy and bureaucratic politics of educational organizations, with special attention to the policy making, implementation, and evaluation processes.

Cross-listed with: EDTHP 587, HIED 587

EDLDR 588: Qualitative Methods in Educational Research II

3 Credits

Advanced study of methods involved in executing and analyzing qualitative research in education. EDLDR (EDTHP, HI ED) 588 Qualitative Methods in Educational Research II (3) The course will provide practical experience with methods of qualitative data collection, data management, and preliminary data analysis that extends and deepens students' understanding of qualitative research in education. The class, limited to 15 students, will take as the focus with inquiry a common "site" around which projects of individual and group interest will be designed. Sessions will take place in "workshop" blocks during which students will present and critique the work of the project. Readings will be interspersed with the practicing of methods. The final project for the course will be the

compilation of a synthesized data set that could serve as the basis of further analysis.

Prerequisite: EDLDR586

Cross-listed with: EDTHP 588, HIED 588

EDLDR 589: Mixed Methods in Educational and Social Scientific Research

3 Credits

Within the social sciences, interest in and the use of mixed methods has grown dramatically in the last 10-15 years. Whereas it used to be regarded, at best, as something of an impractical oddity and at worst a paradigmatic contradiction in terms, a mixed methods approach to research has increasingly begun to enter the mainstream of methodological acceptability. This course explores various philosophical, epistemological, disciplinary, and design-related debates in relation to the rapidly expanding use of mixed methodologies in educational and social scientific research. It is intended to give students an overview of different mixed methods research approaches, to help students consider the epistemological and paradigmatic implications of mixed method designs, and to encourage students to think about, design, conduct, and/or critique mixed methods research within educational and other social scientific research. In this graduate seminar, students will read and discuss multiple examples of mixed methods studies while simultaneously examining broader critiques of and commentaries on mixed methodological approaches.

Cross-listed with: EDPSY 589

EDLDR 595: Internship

1-18 Credits/Maximum of 18

Supervised, research-oriented, off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

Prerequisite: EDLDR480 , teaching experience and a professional certificate

EDLDR 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

EDLDR 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

EDLDR 597C: ****SPECIAL TOPICS****

3 Credits

EDLDR 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

EDLDR 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

EDLDR 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

EDLDR 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

EDLDR 801: Introduction to Teacher Leadership

3 Credits

This course focuses on understanding teacher leadership and its function with the school system. EDLDR 801 Introduction to Teacher Leadership (3) EDLDR 801 Introduction to Teacher Leadership provides an orderly introduction to new conceptions of teacher leadership in schools. The course focuses on three main areas that are foundational to building understandings of teacher leadership. The first of these areas focuses on who teacher leaders are, how they become teacher leaders, and what it is that teacher leaders do. Both formal and informal roles are discussed along with professional and personal qualities that appear to distinguish teacher leaders. Finally, a clear distinction is made between formal administrative leadership, i.e., building principals and their duties, and the role of teacher leaders. The second area uses a systems perspective to focus on the organizational supports and capacities that are necessary for teacher leadership to grow and flourish. At the district level, the focus is on the development of supportive policies and appropriate programs. At the school level, the focus is on developing a culture of continuous learning/continuous improvement in support of teacher leadership. The third area examines not only how one develops teacher leadership but also what is necessary to sustain and nourish it in schools. The focus is on building relationships, distributing power and authority, and aligning professional learning. These three areas culminate in the development of a practice-based conceptual model of teacher leadership.

EDLDR 802: How Schools Work

3 Credits

Course focuses on understanding schools as learning organizations and how teacher leadership works in such organizations. EDLDR 802 How Schools Work (3) The continuing development of the capacities of schools to become learning organizations is a key aspect of creating capable, competent student learners and effective teachers. A learning organization challenges assumptions, authors and reflects upon essential questions, explores innovative approaches, and through collaborative leadership structures applies these learnings to improve instructional and environmental practices for students and teachers. The objective of this course is to examine four critical areas contributing to the understanding of how schools do work and, most importantly, how they can work, as learning organizations. Effective educational leaders must (1) understand the nature of schools as learning organizations; (2) the significant impact of global social, economic, and demographic changes on schooling; (3) the challenges, opportunities, and constraints

of implementing systemic change initiatives; and, (4) the complexities of leadership in such multifaceted organizations as schools.

EDLDR 831: Leadership for Equity and Diversity

3 Credits

Students from culturally, linguistically, socially, and economically diverse backgrounds account for an increasing percentage of the school-age population in the United States. This course serves as an exploration of the school leaders' role in promoting equity and diversity for all members of the school community. Specifically, this course will focus on policy and theory as they inform the development of leadership practice. This course aims to explore issues related to education, equity, and diversity.

EDLDR 841: Data Informed Leadership

3 Credits

This course focuses on the development of skills related to data use that will help inform administrative and leadership decisions in school settings. The purpose of the course is to build the learner's knowledge and skills for understanding and using a variety of different forms of data to promote improvements in student outcomes and increased equity. This class will be most relevant to those working in K-12 school settings, particularly those who are engaged in using different forms of data to improve instruction and/or schools.

EDLDR 842: Coaching for Leadership Capacity and Systems Change

3 Credits

This course develops one's capability to support principals and their teams through coaching to successfully engage in continuous cycles of improvement. Candidates will develop their leadership capacity while collaboratively leading a change effort that ultimately results in success for every student. This is a key competence for principals who will coach other principals.

Prerequisite: EDLDR 841

EDLDR 844: Constructing Educational Case Studies for Peer Professional Development

3 Credits

Students will, under faculty guidance, review events or projects they have conducted in their school and assess its suitability to be developed as a case study. After selecting the case, students will be guided in developing a case study that can be employed in future professional development. Students will write up a case study that articulates the context, vision, theory of action, strategies, evaluation, and resources utilized by the candidate to effect a systemic improvement to their school. Students will critically examine how case studies serve as teaching tools, and reflect on how their lived experience/active practice can be transformed into teaching materials that can develop the administrative skills of future principals.

Prerequisite: EDLDR 841 and EDLDR 842

EDLDR 859: Planned Change for School Improvement

3 Credits

Standards-based reforms of the past have brought about efforts to improve schools and raise student achievement. Initiatives include (but

are not limited to): (1) introduction of standards for learning at all levels of K-12 instruction, including the Common Core Standards introduced in 2011; (2) increased requirements for high school graduation; (3) reduced class sizes, especially in the elementary grades; (4) high-stakes state testing and accountability measures. Yet, despite all this activity and attention, significant changes in student achievement and in basic school practices have been slow to transpire. The reasons for slow progress are many and complex. However, one reason is the need for stronger school leaders (including teachers, principals, superintendents, and other educators) who can direct and implement changes in curriculum, instruction, and school organization. There is consensus in the research literature that school improvement and school leadership are largely inseparable—that leadership is a critical element in order for schools to improve. The course addresses three major questions: (1) What is school improvement? (2) What does it involve? (3) How do we do it? To accomplish this, the course focuses on several general models developed for school improvement purposes. It also explores the component pieces of school improvement, including leadership, professional development/professional learning communities, and a focus on teaching and learning including standards, instruction, and assessments. Taken together, this course explores what education leaders need to know and be able to do to strengthen instruction and raise student achievement. If leaders are to nurture better teaching and learning, they will need greater familiarity with promising instructional approaches, new curricular materials, and ways to adapt them to a particular school's circumstances.

EDLDR 861: Principles of Instructional Leadership

3 Credits

The purpose of this course is to provide aspiring leaders with learning opportunities and activities authentic to school leaders and leadership roles in educational organizations. While the course is suited to meet the needs of educators preparing for principal positions in K-12 schools, it also serves to meet the needs of aspiring leaders in specific content areas, including special education leaders and curriculum leaders often employed across K-12 as teacher leaders or administrators. The course focuses on development of leadership skills and dispositions that inform highly effective practices of instructional leaders in education. Throughout the course, students explore and investigate social and institutional settings for instructional leadership, including supervision of instructional staff and the functions, activities, and practices of an instructional leader. Students will continually work to develop and refine leadership dispositions, specifically those that support instructional improvement and high levels of learning for all students. Throughout the course, students are provided with opportunities to apply activities and learning to their specific interests, at all levels of instruction and content within schools and educational organizations. Students are expected to have teaching and/or school administrator experience, 18 credits in education (at least five of which are methods of teaching), and access to a school setting for course activities and projects.

EDLDR 865: Human Resources Leadership in Education

3 Credits/Maximum of 3

This course will provide an overview of the critical strategic and operational leadership roles in human resources management for future and practicing administrators. Using a systems approach, this course will help leaders to identify the components of effective human resources management while also understanding how these components are interrelated and support strategic planning towards equitable teaching and learning. Additionally, this course will consider local state and

federal policy, as well as legal and ethical responsibilities, dimensions of equity and diversity and a changing work force in: recruitment, selection, induction, retention, evaluation, professional development, collective bargaining and compensation of school personnel.

Prerequisite: 18 credits in education and three years' teaching experience

EDLDR 868: The Principalship for Aspiring School Leaders

3 Credits

The Principalship course provides students with knowledge specific to the role of the principal in K-12 schools. The course is intended to help students gain theoretical and practical insight into what it means to be an effective principal. It explores principal leadership responsibilities, decision-making/problem-solving skills, and management practices across levels of K-12 leadership. The course calls on students to read, think, write about, and discuss multiple topics related to the day-to-day challenges of a building leader.

EDLDR 873: Money and Schools: Perspectives, Finance Policies, and Leadership

3 Credits

How we raise money for schools and how we spend that money reflects our values. This course gives students an overview of the values and policies shaping school finance in the United States, with a special emphasis on the relationship between education funding and equity. Students will also develop their understanding of technical topics in school finance such as how leaders build and maintain a budget. In learning to think critically about funding issues in education, students will consider the relationship between financial management, educational leadership, and organizational change.

EDLDR 876: Law and Education for Educational Leaders

3 Credits

This course will provide an overview of major issues in school law. The course will focus primarily on case law including U.S. Supreme Court decisions as well as relevant state and federal lower court opinions. State legislation and administrative laws will also be considered. Topics to be covered include church/state issues, teacher and student rights, and law associated with equal educational opportunities for various groups including racial and linguistic minorities, individuals with disabilities, and women.

EDLDR 894: **SPECIAL TOPICS**

3 Credits

EDLDR 894 Capstone Inquiry Project (3) EDLDR 894 is the culminating course for the on-line M.Ed. in Educational Leadership with an Option in Teacher Leadership. The course is designed around the presentation of a independent inquiry project that reflects the student's developing understanding of the five leadership strands upon which the program is based. While a good deal of latitude is provided to students in designing their project (usually in conjunction with the First Tier course, CI 501 Teacher Inquiry), course faculty and academic advisors also support and guide the student in project development and continuing work across the program. In addition, several general principles guide and shape the specific project work which continues over the course of the M.Ed. program. In addition to the inquiry project being focused on a problem of practice taken from the student's professional work, the final inquiry

project should also give evidence of the following elements: (1) a focus on improvement of schooling practices and/or student learning; (2) the use of current research and instances of exemplary practices; (3) incorporation of authentic learning experiences anchored in practice; (4) the use of an inquiry-based model of learning and reflection; and (5) collaborative work either among on-line program participants or with participants outside the program. A portfolio of evidence pertaining to (1) individuals' reflections on teacher leadership, (2) other forms of documentation of instances of opportunities for teacher leadership, and (3) the development of the individual inquiry project will be maintained across the student's progression through the program and can be incorporated into the presentation of the inquiry project or into the synthesis and reflection paper.

EDLDR 895: Internship

1-18 Credits/Maximum of 18

Supervised, professionally oriented, off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

Educational Psychology (EDPSY)

EDPSY 502: Data Analysis Workshop

3 Credits

This course is designed to increase conceptual understanding of basic statistics and proficiency with analytic techniques. EDPSY 502 Data Analysis Workshop (3) This course is designed for students with a desire to increase their conceptual understanding of basic statistics and their proficiency with analytic techniques using educational data sets. Through this course students will increase their knowledge of research methods and analytic strategies. An emphasis is placed on the connections among research design, research questions, analysis strategy, and interpretation of findings to supplement their statistics coursework. The course will be held in a computer lab so students can access a statistical analysis package. This course draws on students' knowledge and skills from research methods and statistics courses. In this elective workshop-style class, students are provided a conceptual review of quantitative statistical analysis. In each session hands-on activities and practice with provided educational data sets allow students to learn techniques and interpretation of conducted analysis. Through this course students become more comfortable with analyzing quantitative data sets. The data sets used in the course include segments of large scale educational data sets as well as smaller data sets that include relevant variables for education or educational psychology. These data sets are either portions of actual sets, or fictitious sets with variables labeled with relevant constructs. There are no general data sets included in the course. Each session starts with a teacher-directed review, followed by a model analysis, and guided practice. Students then practice analyzing and interpreting with provided example data sets. Students exit the course with a set of models to reference in their future work.

Prerequisite: EDPSY406 and EDPSY475

EDPSY 505: Statistical Applications in Educational Research

3 Credits

Statistical techniques for education research including multiple regression, one-way, two-way, and repeated measures ANOVA. Use computer software for statistical analyses.

Prerequisite: EDPSY406

EDPSY 506: Advanced Techniques for Analyzing Educational Experiments

3 Credits

Analytical and experimental control considerations for designs involving nested and/or crossed subjects. Analysis of variance and multiple comparisons via computers. EDPSY 506 Advanced Techniques for Analyzing Educational Experiments (3) The main purpose of this course is to introduce a variety of experimental designs that are used in education and the social and behavioral sciences. Experimental designs involve plans for choosing experimental units, assigning treatments, and collecting measurements. The goal is to design informative studies and carry out powerful analyses to answer research questions within practical constraints. For each design, appropriate statistical analyses including the mathematical model, underlying assumptions, computational routines, and the statistical tests of hypotheses will be covered. Relative advantages and disadvantages of the different designs will be discussed. The course will provide hands-on opportunities to practice data analysis and result interpretation. In light of likely differences in students' academic backgrounds, the course emphasizes conceptual understanding rather than mathematics of the statistical methods.

Prerequisite: EDPSY505 or PSYCH400

EDPSY 507: Multivariate Procedures in Educational Research

3 Credits

Introduction to matrix algebra, computer programming, multiple regression analysis, multiple and canonical correlation, multiple discriminant analysis, classification procedures, factor analysis. EDPSY 507 Multivariate Procedures in Educational Research (3) This course covers analytical techniques in the analysis of variable relationships. It focuses on regression-based statistical techniques in explaining or predicting outcome variables from other relevant measured variables. Simple and multiple regression analysis of continuous outcome variables and logistic regression analysis of categorical outcome variables will be discussed along with model diagnostics. Other topics considered include applications of discriminant analysis for classification problems, exploratory factor analysis for data reduction and discovering the number of latent dimensions, and if time permits, cluster analysis for identifying patterns of individual responses. The course will provide hands-on opportunities to practice data analysis and result interpretation. The course emphasizes conceptual understanding rather than mathematics of the statistical methods.

Prerequisite: EDPSY505 or PSYCH400

EDPSY 512: Group Processes in the Classroom

3 Credits

Basic concepts and perspectives in the study of group processes; instructional group interaction; analysis of classroom behavior.

EDPSY 513: Individual and Group Differences

3 Credits

Description, causes, and interpretation of individual variation over the life-span, with application to school and institutional practices.

Prerequisite: EDPSY400 or EDPSY450

EDPSY 515: Foundations of Educational Research

3 Credits/Maximum of 999

Students read the philosophical foundations of education research, study how philosophies influence methodologies, and analyze current educational problems. This course is designed for students entering doctoral programs in the College of Education. Our students are studying to become education researchers within a highly politicized environment. For example, particular definitions of education research and government policies that favor some types of research practices over others provide opportunities for and set limits upon the work of education researchers. Public controversies likewise contribute to challenges faced by education researchers who find their work affirmed or discounted by particular definitions and policies. In order to explore these controversies and to allow students to begin identifying their own "positionality" with regard to research, this course begins with a reading of the history and philosophies of education research (primarily focusing on the United States). The course goals are: - to identify underlying assumptions of competing forms of social inquiry, each determined to uncover new knowledge; - to bring those assumptions to bear on education research in chosen fields of study; and - to begin to develop one's own positions in order to direct further study and research. Specifically, through instructor facilitation and group discussions, students will come to understand major philosophical perspectives that permeate and drive research methodologies in education: positivism, postpositivism, interpretivism, critical theory, poststructuralism, and pragmatism. These understandings allow students to recognize the methodological assumptions that inform published research studies and to discover how methodologies might inform the research they wish to conduct as students and practitioners. Although the course is not required by any particular doctoral program in the College of Education, it is suggested for students who consider research important to their future careers and who see benefits in exploring the methodological options available.

Cross-listed with: ADTED 515, CI 515, HIED 515

EDPSY 520: Current Issues in Special Education

3 Credits

Explore current issues and research in the field of special education.

Prerequisite: SPLED525

Cross-listed with: SPLED 520

EDPSY 521: Learning and Cognition: Educational Applications

3 Credits

This course focuses on understanding human learning and thinking through examining learning theories and research related to educational psychology.

Prerequisite: EDPSY421

EDPSY 523: Concept Learning and Problem Solving

3-4 Credits/Maximum of 4

Theoretical-empirical trends in concept learning, problem solving, and creativity related to instructional psychology. EDPSY 523 Concept Learning and Problem Solving (3 to 4 per semester/maximum of 4) This course explores how people acquire knowledge of concepts and the nature of that knowledge. Students will also learn about major models of problem solving and issues related to how people solve problems. The two main topics of the course, concept learning and problem solving, are tied together by exploring how the knowledge that one has influences problem solving and how the experiences of problem solving influence the knowledge that is gained. Students are encouraged to apply the topics of this course to their own areas of study through activities such as selecting relevant research articles, development of a research proposal, and applying research findings to new areas.

Prerequisite: EDPSY421 or EDPSY521

EDPSY 524: Theories of Learning and Instruction

3 Credits

Study of major classical theories of learning and recent developments in learning and instructional theory. EDPSY 524 Theories of Learning and Instruction (3) Exploration of major classical and current theories of learning from behaviorism to situated cognition through the reading of original works, extensive overview chapters, and contemporary empirical research. Course content and readings assume that students have prior knowledge or experience with learning theory.

Prerequisite: EDPSY421 or EDPSY521

EDPSY 525: Cognitive Processes in Learning from Multiple Representations

3 Credits

Multiple external representations (MERs) refer to instructional materials that contain more than one representation for describing or depicting content. Examples are materials that include two or more representations such as verbal text, formulae, diagrams, graphs, animations, and so on. This course will also cover materials that include multiple text documents. Regardless of the specific representational combinations used, acquiring knowledge from these representations requires the learner to both comprehend the individual representations and integrate across them, a demand that students often face, but infrequently achieve. This course will cover the major theoretical frameworks used to understand the cognitive processes required for learning from MERs as well as current research addressing these processes.

EDPSY 526: The Psychology of Reading

3 Credits

Psychological principles underlying the process of reading and comprehending, with application to instruction. EDPSY 526 The Psychology of Reading (3) This course explores the psychological processes of reading including topics such as phonological processing, vocabulary development, and comprehension. Students in this course will complete readings that help them to understand the research foundations for these psychological processes of reading and how these processes can be understood in relation to one another. Throughout the course, students will be encouraged to consider how each topic relates

to broader considerations in the field of reading. For example, the class may explore how knowledge of psychological processes can be applied to address questions of beginning reading instruction, second language learning, and text design. A variety of class formats, such as small group discussions and topic presentations, may be used to support these explorations.

Prerequisite: EDPSY421 or EDPSY521

EDPSY 528: Instructional Psychology

3 Credits

Application to instructional design of current developments in research on human development, information processing, learning strategies, memory structures, instructional processes. EDPSY 528 Instructional Psychology (3) The objective of this course deals with psychological research on mental structures and on the relation of these to learning of basic skills and school subjects exhibiting increasing capability for investigating and implementing emerging principles that meet the complex demands of education and instructional practice. The content and requirements of this course will be shifting continually to keep up with these developments. This course relates various phases of instruction to correlated processes engaged by the learner. The readings will be from the journal literature and/or recent textbooks.

Prerequisite: EDPSY421 or EDPSY521

EDPSY 530: Achievement Motivation

3 Credits

Within a seminar format, this course addresses both theoretical and empirical approaches to motivation and other related affective constructs.

Prerequisite: EDPSY421

EDPSY 550: Design and Construction of Psychological Measures

3 Credits

Lecture-practicum involving planning, construction, administration, and analysis of a psychological test; lectures stress construct validity, item analysis, and predictive validity.

Prerequisite: EDPSY450

EDPSY 554: Theories of Psychological Measurement

3 Credits

Basic true-score and error models; their extensions to test reliability and test validity; problems of item analysis and weighting.

Prerequisite: EDPSY450

EDPSY 555: Validity of Assessment Results

3 Credits

Concepts, issues, and methods of validation of educational and psychological assessment including models and approaches to validation, bias, and utility. EDPSY (CI ED) 555 Validity of Assessment Results (3) The goal of this course is to enable the student to acquire a broad perspective on issues and considerations in the process of validating interpretation and uses of tests, scales, assessment

procedures, or protocols. Issues of validity are examined from many perspectives including a review of current dominant and alternative validity theories, of known threats to validity, of some advanced specialized statistical techniques; and of test bias, legal issues, psychological/behavioral issues, social/consequential considerations, and philosophical considerations. Additionally, applications are provided through in-depth cross-cultural and historical studies, technical reviews of published commercial tests, and in-depth examinations of controversies.

Prerequisite: EDPSY406 , EDPSY450

Cross-listed with: CIED 555

EDPSY 556: Foundations and Applications of Item Response Theory

3 Credits

Unidimensional models for dichotomously scored and polytomously scored items and their applications in instrument/test development.

Prerequisite: EDPSY450 and EDPSY507

EDPSY 557: Hierarchical Linear Modeling in Educational Research

3 Credits

Statistical techniques for the analysis of multilevel data such as in nested designs or hierarchical data. EDPSY 557 Hierarchical Linear Modeling in Education Research (3) Hierarchical Linear Modeling (HLM) models are particularly important when analyzing data for school settings. This course is designed as an applied statistics course specifically geared to analyzing data from educational settings and using data sets from educational research. Data collected in these ecological contexts with nested designs, such as students enrolled in classrooms, classrooms in schools, and schools within school districts, must be analyzed carefully as relations between and among variables could change given a particular level (e.g., student-level, classroom-level) for analysis. The topics of this course highlight the importance of studying random versus fixed effects for data collected in multilevel educational research settings. Two-level HLM models, growth-curve models, three-level HLM models, and Hierarchical Generalized Linear Models with binary and ordinal outcomes are the four primary types of models that will be the focus of the class. Students will also learn how to use HLM software to analyze their data given the four types of models. Other topics covered in this class will include: a) centering of independent variables; b) restricted maximum likelihood estimation; c) effect sizes and power analysis; and d) the relevance of educational theory and psychometric analysis in variable selection, and model specification.

Prerequisite: EDPSY506 and EDPSY507

EDPSY 558: Foundations and Applications of Structural Equation Modeling

3 Credits

Model specification, identification, estimation, evaluation, and modification for measurement models, path models, and full structural models. EDPSY 558 Foundations and Applications of Structural Equation Modeling (3) Structural Equation Modeling (SEM) is considered an advanced multivariate statistical tool. It subsumes general linear models such as ANOVA and regression and can model binary, ordinal, or count data like logistic and Poisson regression. SEM is multi-disciplinary and is most widely used in Social and Behavioral sciences. This course covers foundational issues in Structural Equation Modeling. Path analysis,

confirmatory factor analysis, and full structural models will be discussed in terms of model specification, identification, estimation, evaluation, and modification. Students will learn how to specify models of theoretical interest, recognize identification problems, perform model estimation and modification using an SEM software of choice, and defend the final model selected. Examples of model fitting will be illustrated in class with the LISREL program. However, students are encouraged to explore other SEM programs that best suit their skills and research interests. A class project involving the application of the newly acquired techniques is required.

Prerequisite: EDPSY406 , EDPSY507 , and STAT 505

EDPSY 559: Foundations of Meta-analysis

3 Credits

Foundations of Meta-analysis covers the application of concepts and principles of meta-analysis to the systematic review of the literature on a topic. It covers how to model effect sizes (e.g., Hedge's g , odds ratio, Fisher's z) in between-subjects, within subjects, meta-regression, and correlation-based meta-analyses. Topics include the design, statistical modeling and analysis, and reporting of meta-analytic studies. Upon completion of the course, students should be able to design and conduct meta-analyses, as well as be informed consumers of meta-analytic reports.

Prerequisite: EDPSY 406; EDPSY 505; HDFS 519; PLSC 502; PPOL 503; PSY 507; STAT 415; STAT 500; STAT 501 Recommended Preparation: It is advisable to have some experience reviewing the literature, either through formal coursework or research experience.

EDPSY 560: Contemporary Issues in the Evaluation of Educational Programs

3 Credits

Practical and theoretical issues in the planning, execution, and interpretation of program evaluations.

Prerequisite: EDPSY450 , EDPSY475

EDPSY 575: Seminar in Educational Psychology

1-6 Credits/Maximum of 6

A seminar dealing with specific topics in educational psychology. Open to advanced students in the behavioral sciences.

EDPSY 576: Research Methods in Teacher Education

3 Credits

A basis in theory, findings from research, research design, and methodologies related to teacher education.

Cross-listed with: C-S 576

EDPSY 578: Contemporary Issues in Interdisciplinary Educational Intervention Sciences

2-3 Credits

Proseminar exploring contemporary issues in the design and evaluation of educational interventions from an interdisciplinary perspective.

Cross-listed with: HDFS 578, PSY 578

EDPSY 589: Mixed Methods in Educational and Social Scientific Research

3 Credits

Within the social sciences, interest in and the use of mixed methods has grown dramatically in the last 10-15 years. Whereas it used to be regarded, at best, as something of an impractical oddity and at worst a paradigmatic contradiction in terms, a mixed methods approach to research has increasingly begun to enter the mainstream of methodological acceptability. This course explores various philosophical, epistemological, disciplinary, and design-related debates in relation to the rapidly expanding use of mixed methodologies in educational and social scientific research. It is intended to give students an overview of different mixed methods research approaches, to help students consider the epistemological and paradigmatic implications of mixed method designs, and to encourage students to think about, design, conduct, and/or critique mixed methods research within educational and other social scientific research. In this graduate seminar, students will read and discuss multiple examples of mixed methods studies while simultaneously examining broader critiques of and commentaries on mixed methodological approaches.

Cross-listed with: EDLDR 589

EDPSY 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

EDPSY 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

EDPSY 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

EDPSY 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

EDPSY 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Teaching of Educational Psychology classes under senior faculty supervision.

EDPSY 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

EDPSY 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

Educational Technology (EDTEC)

EDTEC 561: Measuring the Impact of Technology on Learning

3 Credits

Prepares teachers to evaluate the effects of technology use. EDTEC 561 Measuring the Impact of Technology on Learning (3) This course which will be offered online through Penn State's "World Campus," is designed to prepare teachers and other educators to use basic quantitative methods to assess the effects of a variety of technology-related innovations in their own classrooms and schools. It begins with a focus on the various types of learning outcomes, then prepares students to develop the effective tests and scoring tools required to assess them. The course then introduces the basic statistical concepts and methods, reviews exemplary technology-related quantitative research, and prepares students to design quantitative research studies to be implemented in their own classrooms and schools.

Prerequisite: EDPSY421 or equivalent and AEE 521 or equivalent

EDTEC 594: Research Topics

1-9 Credits/Maximum of 9

Supervised student activities on research projects identified on an individual or small-group basis.

Prerequisite: EDTEC566 or EDTEC567

EDTEC 595: Internship

1-9 Credits/Maximum of 9

Supervised off-campus, nongroup instruction, including field experiences, practicums, or internships.

EDTEC 596: Independent Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, supervised on an individual basis and which fall outside the scope of formal courses.

Educational Theory and Policy (EDTHP)

EDTHP 500: Proseminar in Educational Theory and Policy

3 Credits

An introduction to disciplinary and interdisciplinary studies in educational theory and policy.

EDTHP 507: Ethnicity, National Identity, and Education

3 Credits

Surveys group-oriented education policies internationally, especially comparing those of Britain, Taiwan, India.

Cross-listed with: CIED 503, HIED 503

EDTHP 516: Education and Demographic Change

3 Credits

Education is one of the most important factors affecting major demographic shifts and processes worldwide, including the first and second demographic transitions. If, as the old sociological adage goes "demography is destiny," then our destiny is educationally transformed demography. Interdisciplinary research across demography, sociology, neuropsychology, and epidemiology is developing a strong research literature about how the thinking style, behavior, and attitudes of the educated human radically change fundamental dynamics underlying the world's population. The whole way in which we come to our jobs, spouses, and lifestyles; how many children we have and how we raise them; how long we are likely to live, and what will be our eventual demise are all heavily influenced by how much education we have had. The collective force of widespread education and its influence on rising cognitive abilities, scripts for living, and economic well-being are creating a distinctly new type of human population with major benefits and future challenges for a sustainable human population. At the same time, individuals' schooling is also influenced by demographic change. This seminar covers key concepts, theories, and methodological issues related to the intersection of demographical and cultural changes from the education revolution and their impact on subsequent demographic processes.

Cross-listed with: CIED 516, SOC 516

EDTHP 518: Analysis of U. S. Educational Policy

3 Credits

The interaction between educational theory and social structure, focusing on the role of practicing intellectuals in contemporary institutional settings.

EDTHP 520: Perspectives on Contemporary School Reform

3 Credits

Examination of contemporary U.S. school reform, with a focus on contrasting theoretical perspectives and the application of policy analysis principles. EDTHP 520 Perspectives on Contemporary School Reform (3) This course examines contemporary U.S. school reform, with several purposes, with a focus on contrasting theoretical perspectives and the application of policy analysis principles. It consists of the following objectives: 1. To gain an appreciation of how school reforms develop, including the rationale behind them and how visions of school change become mediated by social and political contexts as they become policy. 2. To analyze what produces continuity and change in schools and classrooms, including why some reforms persist, why some fade, and why some recur. 3. To gain an understanding that the implementation of school reform is a product of the interaction between the larger context (social, economic, political, ideological, and environmental factors), the character of schools as institutions, and the actions of groups and individuals. 4. To gain and strengthen skills in analyzing a policy argument, its assumptions, and use of evidence in order to construct a coherent and compelling policy analysis of a school reform on your own. The course is an advanced seminar with approximately 15 students enrolled. The course will be offered once in every two-year (4 semester) cycle. Course evaluation includes policy analysis exercises, weekly written responses to readings, responsibility for leading the seminar, and a cumulative research paper examining and

analyzing a school reform. Attendance and participation also are part of the course evaluation.

EDTHP 521: Data Analysis for Education Research

3 Credits

This course bridges theoretical statistics coursework and practical research with real, large-scale data sets. The course emphasizes hands-on data preparation and analysis using statistical software. More specifically, the course will give an overview of national and international data resources that are available for educational researchers, survey the most widely used data analysis techniques in educational research, and use statistical software and large-scale datasets to produce useful results for educational policy research.

Cross-listed with: EDLDR 521, HIED 521

EDTHP 522: Economics of Education

3 Credits

The aim of the course is to help students view the educational system and students' educational decisions through the lens of economics. We will discuss the methods that economists commonly employ to study education and read recent empirical articles that examine the impact of educational policies and practices. At the end of the semester, we will discuss insights from the field of behavioral economics, which builds on the standard economic model to better understand decision making. This course also surveys the empirical literature on the economics of education which is organized into several broad topics, including human capital and economic return to education, school choice and college access, and education production. Finally, the course covers a variety of econometric methods that are widely used in the economic study of education. These methods include regression models (e.g., ordinary least squares, discrete choice models, Multi-level modeling, panel data models, etc.) and commonly used techniques to deal with self-selection and causal inference (e.g., quasi-experimental methods).

Cross-listed with: EDLDR 522, HIED 522

EDTHP 523: Interpreting and Analyzing Quantitative Studies in Education Policy

3 Credits

Effective reading of academic articles in educational policy based on quantitative methods.

Prerequisite: EDPSY400 and EDPSY406

EDTHP 524: Comparative Education Research Using Large-Scale Data

3 Credits

This course is designed to give students an overview of large-scale international assessment databases and to demonstrate how these databases can be utilized to investigate critical issues in education from a comparative perspective. A number of empirical studies using large-scale international assessment databases will be reviewed, and these analyses will be replicated via computer labs. Students will develop a good understanding of large-scale international assessment databases and will learn to apply an appropriate method to address a particular topic of interest. Students will also develop a wide range of research skills necessary to independently conduct comparative research, including but not limited to formulating a research question,

conducting a literature review, analyzing empirical data, and interpreting results. Although the focus is mainly on datasets relevant to education and education policy research, the skills taught in the course are broadly transferable to other social sciences including sociology.

Recommended Preparations: Students should have taken either EDTHP 513 and EDTHP 538 or EDTHP 553 as well as EDPSY 505 or SOC 574 before enrolling in this course.

Cross-listed with: CIED 524, EDLDR 524, HIED 524

EDTHP 527: Testing and Educational Equity

3 Credits

This course considers testing, the reasons that policymakers have widely adopted testing, and implications of testing for educational equity. EDTHP 527 Testing and Educational Equity (3) Results from standardized testing reveal that there are large disparities in test scores that parallel racial and ethnic lines in the U.S. For almost two decades, American policymakers have embraced increased testing in K-12 education as a means of reducing these disparities. The objectives of this course are to help you to understand why testing policies have proliferated, to explore how such policies might or might not affect academic achievement, and to think critically with regard to the policies' impact on students from diverse racial and ethnic backgrounds. In essence, the course's central question is this: In what ways might testing policies ameliorate or increase disparities across racial and ethnic groups?

EDTHP 533: Social History and Education Policy

3 Credits

Historical study of social dimensions in the formation of education policy.

EDTHP 534: Childhood and Education in Sociological and International Comparative Perspective

3 Credits

The course objective is to use an international comparative lens and sociological perspective to examine the social, cultural, political and economic forces that shape childhood and the role education plays in this process.

Cross-listed with: CIED 534, SOC 534

EDTHP 536: Studies in Educational Thought

3 Credits

Studies in the historical development of educational theory.

EDTHP 538: Sociology of Education

3 Credits

Provides students with an overview of dominant sociological theoretical perspectives on schools, schooling, and education in modern society. SOC (EDTHP) 538 Sociology of Education (3) This graduate course in the Sociology of Education covers the major sociological theories and empirical research on the role of formal education in society. The object of the course is to have the student become conversant with the main lines of sociological research applied to education and social development at the individual, community, and societal levels. Since sociology of education has had considerable impact on educational policy over the past 50 years, a second goal of the course

is to understand this relationship and avenues for future research and policy analysis from a sociological perspective. This course is a central topic in the general study of social stratification and hence in pursuit of the Ph.D. in the Educational Theory and Policy and the Sociology program. The format of the course is a didactic seminar with extensive written assignments as the usual form of evaluation.

Cross-listed with: SOC 538

EDTHP 540: Youth Participation in Educational Change: Examining Youth Activism, Child Rights, and Youth Voice

3 Credits

Cross-listed with: CIED 540, EDCE 540

EDTHP 541: Contemporary Philosophies of Education

3 Credits

Educational theory and practice in relation to contemporary movements in philosophy. CI ED 541 CI ED (EDTHP) 541 Contemporary Philosophies of Education (3) This graduate seminar explores a range of contemporary philosophies of education viewed from the perspective of different varieties of postmodernism. The study of modern and postmodern western thought is combined with explorations of eastern thought including viewpoints that are emerging today in both the northern and southern hemispheres. While focusing on contemporary educational ideas, it traces their roots in classical and non-modern philosophical sources. This look at the present in terms of the past reveals the paradigm shift presented by contemporary postmodern educational thought. In doing so, considerations for the issues of race, class, gender, ecology, multiculturalism and the regeneration of diverse incommensurable cosmologies, severed or overlooked by some educational philosophers, are explored in their reintegration by contemporary postmodern philosophers of education.

Cross-listed with: CIED 541

EDTHP 542: Civil Rights and Education

3 Credits

Examination of civil rights policies and educational equity in the U.S. from the perspectives of law, social science, accountability policy. Civil Rights and Education will examine civil rights policies and educational equity in the United States from the perspectives of social science, education policy, and law. The aims of the course are to build students' understanding of the key principles of civil rights policies and the sources of contention in civil rights, and to enhance students' capacity for participating in issues of civil rights and education through project-based work. We will begin by considering what it means to have an opportunity to learn and how it has been defined. The course will then consider legal and policy developments since the "Brown" decision that have both expanded and constrained the opportunity for certain groups of students. The course is primarily focused on national developments, but does include a focus specifically on educational opportunity in Pennsylvania. The course concludes by considering recent civil rights developments and prospects for the future. Cross Listings: EDLDR 542 will be added as a cross-listed course.

Cross-listed with: EDLDR 542

EDTHP 550: Comparative Education Policy Seminar

3 Credits

Examines the educational policy process world-wide and the influence on schooling of children, youth, and adults in national education systems. CI ED (EDTHP) 550 Comparative Education Policy Seminar (3) In this course students will learn how educational policy is made around the world and what influence this policy has on the schooling of children, youth, and adults in national systems of education. Students will examine recent trends in educational policy that have originated at the international level. Methods of policy research and evaluation will also be examined. The main goal of the course is to give students an understanding of international processes in policy formation and detailed knowledge of current education policy trends worldwide.

Cross-listed with: CIED 550

EDTHP 553: Educational Mobility in Comparative Perspective

3 Credits

Role of education in social mobility, using quantitative, qualitative, and historical methods; focuses comparatively on Britain, East Asia, and South America. CI ED 553/SOC 553/EDTHP 553/CI ED 553. (SOC 553, EDTHP 553, HI ED 553) Educational Mobility in Comparative Perspective (3) Sociologists interested in higher education have attended to the relationships between postsecondary institutions and other institutions, as well as the impact on higher education of general social and demographic processes. Many of the classical ideas in sociological theory, including those of Max Weber and Emile Durkheim, have surfaced in recent debates over the nature of higher education. Sociologists in the U.S. have explored such questions as: the gatekeeping function of higher education; the impact of universities on stratification; and the socializing environment for women and minorities. This seminar introduces some of the classical theorists and contemporary researchers of the sociology of higher education. All seminar participants will be required to write a sample research proposal, based on the readings from the seminar.

Cross-listed with: CIED 553, HIED 553, SOC 553

EDTHP 555: Migration and Children's Education

3 Credits

The research theories and policies useful for understanding the schooling processes and outcomes of immigrants' children. EDTHP 555 Migration and Children's Education (3) This course focuses on the theories and policies pertaining to the educational achievement, attainment, and engagement of immigrants' children. Immigrants' children include foreign-born children (first generation) and native-born children of foreign-born parents (second generation). The course includes a survey of empirical research on the educational differences (the generational gap) between three groups: first-generation, second-generation, and higher generations. The course aims at helping education researchers and school leaders understand the mechanisms through which generational gaps are created and maintained by examining a host of family, community, and particularly school factors. Key school factors include: bilingual policies, tracking, ability grouping, special education placement, and segregation. Although the focus is primarily on children of contemporary legal and undocumented immigrants in the United States, this course also addresses the schooling of children in countries that send immigrants to the United States, as well as immigrants'

children in other receiving countries of the world, such as East Asian and Western European countries.

EDTHP 557: Sociology of Higher Education

3 Credits

Reviews theory and current sociology research on student access, achievement, and governance in postsecondary education, with applications to policy analysis. EDTHP (HI ED, SOC) 557 Sociology of Higher Education (3) Sociologists interested in higher education have attended to the relationships between postsecondary institutions and other institutions, as well as the impact on higher education of general social and demographic processes. Many of the classical ideas in sociological theory, including those of Max Weber and Emile Durkheim, have surfaced in recent debates over the nature of higher education. Sociologists in the U.S. have explored such questions as: the gatekeeping function of higher education; the impact of universities on stratification; and the socializing environment for women and minorities. This seminar introduces some of the classical theorists and contemporary researchers of the sociology of higher education. All seminar participants will be required to write a sample research proposal, based on the readings from the seminar.

Prerequisite: graduate students only, except with permission of instructor; EDTHP/SOC 416 is recommended
Cross-listed with: HIED 557, SOC 557

EDTHP 565: Causal Inference in Educational Policy Research

3 Credits

This course is designed to help students develop a broad familiarity with the kinds of research designs (e.g., cluster randomized trials) and statistical methods (e.g., propensity score matching, instrumental variables, regression discontinuity) that are helpful in drawing causal inferences in educational policy research.

Prerequisite: EDPSY 505 or SOC 574

EDTHP 580: Improving Educational Writing

3 Credits

Focus on components of high quality academic writing for educational research, with a special emphasis on improving the writing process.

EDTHP 582: Reviewing and Editing Education and Policy Journals

3 Credits

Introduction to education policy journals and the review and editing process; discussion of emerging issues within the academic publishing industry.

Cross-listed with: CIED 582, EDLDR 582, HIED 582

EDTHP 585: Research Design: Implications for Decisions in Higher Education

3 Credits

A capstone course on research design and analytical approaches to support decision-making in administration and policy-making. EDLDR 585 / EDTHP 585 / HIED 585 Research Design: Implications for Decisions in Higher Education (3) By the end of this course you should be able to: (1) Define and explain the following concepts/tools of social

science research: The scientific method-Theory and its role, Constructs and variables, Hypotheses and relations, Experimental designs, Quasi-experimental designs and Ex post facto designs. Sampling theory and designs-Survey designs and methods, Approaches to data collection, Measurement reliability and validity, Quantitative analytical designs, and Ethical practices. (2) Apply these concepts/tools in designing a study relating to educational research. (3) Effectively critique both the theoretical bases and methods of a journal article or report of research or policy analysis. (4) Prepare a sound research proposal.

Prerequisite: EDPSY400 , EDPSY406 ; or AG 400 , R SOC573
Cross-listed with: EDLDR 585, HIED 585

EDTHP 586: Qualitative Methods in Educational Research

3 Credits

Exploration of the theoretical framework undergirding qualitative research and its attendant practices and techniques. EDLDR (EDTHP, HI ED) 586 Qualitative Methods in Educational Research (3) This course is the introductory course in the EPS qualitative research methods sequence. This is the first course in a three-course sequence departmental sequence intended to take students from basic knowledge of qualitative methods through mastery of advanced topics. This course was designed specifically to 1) orient students to the various types of qualitative methods most widely used in educational policy research and their theoretical underpinnings; 2) provide training in basic qualitative research techniques; 3) introduce students to basic research design; 4) provide systematic practice (and feedback) in evaluating qualitative research that would allow students to become sophisticated consumers of qualitative studies; 5) prepare students for the Level 11 course. The course will begin with a brief review the development of qualitative methods in related fields (anthropology, sociology, linguistics) and quickly move on to an overview of qualitative methods in education. Students must have read the material prior to class in order to take part in in-class exercises and discussions. We will focus on key issues such as validity, interpretation and representation. Students will be asked to read studies, assess the general quality of the work, and provide a critical evaluation. Students will study specific methods of qualitative field research, and most weeks we will practice and discuss a particular research technique (e.g. participant observation, focus group interviews). These practice sessions will be informed by relevant readings. Students will practice developing coding schemas as well as get a quick overview of qualitative data analysis (QDA) packages. Finally, in small groups, students will design a basic qualitative study to be presented as a final product in the course.

Cross-listed with: EDLDR 586, HIED 586

EDTHP 587: Education Policy and Politics

3 Credits

The political economy and bureaucratic politics of educational organizations, with special attention to the policy making, implementation, and evaluation processes.

Cross-listed with: EDLDR 587, HIED 587

EDTHP 588: Qualitative Methods in Educational Research II

3 Credits

Advanced study of methods involved in executing and analyzing qualitative research in education. EDLDR (EDTHP, HI ED) 588 Qualitative Methods in Educational Research II (3) The course will provide

practical experience with methods of qualitative data collection, data management, and preliminary data analysis that extends and deepens students' understanding of qualitative research in education. The class, limited to 15 students, will take as the focus with inquiry a common "site" around which projects of individual and group interest will be designed. Sessions will take place in "workshop" blocks during which students will present and critique the work of the project. Readings will be interspersed with the practicing of methods. The final project for the course will be the compilation of a synthesized data set that could serve as the basis of further analysis.

Prerequisite: EDLDR586

Cross-listed with: EDLDR 588, HIED 588

EDTHP 595: Internship

1-18 Credits/Maximum of 18

Supervised, research-oriented, off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

EDTHP 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects including non-thesis research, supervised on an individual basis and which fall outside the scope of formal courses.

EDTHP 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

EDTHP 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

EDTHP 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

EDTHP 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

This class enables doctoral students to gain experience in college teaching under the supervision of a course instructor.

EDTHP 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

EDTHP 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

EDTHP 897: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject with a professional orientation that may be offered infrequently.

Electrical Engineering (EE)

EE 500: Colloquium

1 Credits

Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

EE 510: Linear Integrated Circuits

3 Credits

Design of monolithic, thin-film, and hybrid linear integrated circuits; D.C., video, tuned, r.f., and microwave applications. Emphasis on reliability.

Prerequisite: E E 410 ; E E 441

EE 518: Neuromorphic Computing

3 Credits

This course delves into developments in the field of brain-inspired neuromorphic computing. The course will offer an interdisciplinary perspective across the computing stack combining insights from machine learning, computational neuroscience to materials, devices, circuits and systems. The course will discuss recent research developments in the field by critiquing publications through presentations and will also provide the opportunity to develop a project focused on a particular layer of the computing stack.

Prerequisite: EE 416 or CMPEN 416

EE 520: Electro Optics--Systems and Computing

3 Credits

Synthetic aperture radar, spatial light modulators, optical interconnection, optical computing, neural networks, and medical optics imaging.

Prerequisite: E E 420

EE 521: Fiber Optics and Integrated Optics

3 Credits

Theories and applications of linear and nonlinear optical phenomena in optical fibers and integrated optical devices.

Prerequisite: E E 421

EE 522: Electro-Optics Laboratory

3 Credits

Basic concepts and fundamentals of light diffraction, optical signal processing, and holography.

Prerequisite: E E 420

EE 524: Lasers and Optical Electronics

3 Credits

Study of several advanced nonlinear optical phenomena, laser propagation, optical and optoelectronic devices, principles, and applications.

Prerequisite: E E 424**EE 526: Nonlinear Optical Materials**

3 Credits

Mechanisms of polarization nonlinearity, nonlinear optical processes and analyses, optoelectronic materials and their device application. E E (MATSE) 526 Nonlinear Optical Materials (3) Nonlinear Optical Materials is a course that will generally be offered in spring semesters. It is designed for students who are interested in the materials science-related interdisciplinary electronics/electro-optic engineering areas to provide an essential understanding of the mechanisms of the polarization nonlinearity in electronic materials as well as the principles of operation of these materials in various photonic and optoelectronic applications (e.g., frequency conversion, optical control/communication, and information storage). Analytical methods utilizing the electromagnetic wave theories and tensor operations will be covered in this course to treat anisotropic nonlinear optical materials for their wave-matter interaction processes and to enable device designs. Technological issues in research and development of advanced optoelectronic devices using nonlinear optical materials are discussed with students' participation. Students wishing to take this course should be familiar with optical properties of materials and basic tensor notations.

Prerequisite: E E 420 or MATSE435**EE 531: Engineering Electromagnetics**

3 Credits

This course emphasizes advanced electromagnetic field theory concepts, with application to propagation of electromagnetic waves in material media, wave polarization, reflection and transmission of multiple interfaces, and rectangular and circular cross section waveguides and cavities. In this course, students learn electromagnetic theorems and principles with emphasis on induction equivalent and physical equivalent approximations for solution of electromagnetic scattering problems. At the completion of the course, students will be able to apply integral equations and their moment method solutions for practical electromagnetic radiation and scattering problems. The generalized Green's function method will be introduced, including development of closed form Green's functions in rectangular, cylindrical and spherical geometries.

Prerequisite: E E 430**EE 534: Conformal Antennas**

3 Credits

Introduction to advanced analysis and design techniques as well as applications for conformal antennas mounted on planar and curved surfaces. E E 534 Conformal Antennas (3) E E 534 provides an introduction to the rapidly growing field of conformal antennas. Analysis and design techniques are presented for conformal antennas mounted on planar as well as curved surfaces. Important applications of conformal antennas are also discussed with emphasis on their recent popularity as

wireless PCS, GPS, and body-borne antennas. Microstrip antenna design projects will be assigned, where students will gain valuable experience using one or more commercially available industry-standards modeling codes. E E 534 is the third and most advanced course in a three-course sequence of antenna engineering courses: E E 438 (Antenna Engineering), E E 538 (Antenna Engineering) and E E 534. E E 534 will be taught every other fall semester, with an anticipated enrollment of 20-30 students.

Prerequisite: E E 538**EE 535: Boundary Value Methods of Electromagnetics**

3 Credits

Theory and application of boundary value problems in engineering electromagnetics; topics include microwave and optical waveguides, radiation, and scattering.

Prerequisite: E E 430 or E E 432 or E E 438 or E E 439**EE 537: Numerical and Asymptotic Methods of Electromagnetics**

3 Credits

Finite difference time domain, geometric theory of diffraction and method of moments applied to antennas and scattering.

EE 538: Antenna Engineering

3 Credits

In-depth studies of synthesis methods, aperture sources, broadband antennas, and signal-processing arrays.

Prerequisite: E E 438**EE 541: Manufacturing Methods in Microelectronics**

3 Credits

Methods, tools, and materials used to process advanced silicon integrated circuits.

Prerequisite: E E 441**EE 542: Semiconductor Devices**

3 Credits

Characteristics and limitations of bipolar transistors, diodes, transit time, and bulk-effect devices.

Prerequisite: E E 442**EE 543: Ferroelectric Devices**

3 Credits

Theoretical background of ferroelectric devices, practical materials, device designs, drive/control techniques, and typical applications.

EE 544: Solid-state Mechatronics

3 Credits

This course provides a broad exploration of solid-state mechatronics. Mechatronics deals with solid state devices and systems enabled by piezoelectric effect, electrostatic force, and magnetic and magnetoelectric effect, which are ubiquitous in our society. This course

covers key areas of mechatronics, including device fundamentals, key materials, device designs, typical applications and device examples. Applications and devices include solid state actuators and sensors, energy harvesting systems, filters and resonators in wireless communications, transducers in medical imaging and fault detection, and surface acoustic and other guided wave devices in sensing and communications. This course is suitable to graduate students majoring in electrical engineering, mechanical engineering, engineering science and mechanics, and other related fields, who are interested in learning the theory of solid state actuators, sensors, and transducers and designing them for industrial and biomedical applications.

EE 545: Semiconductor Characterization

3 Credits

Physical principles and experimental methods used to characterize the electrical, optical, structural and chemical properties of semiconductor materials.

Cross-listed with: MATSE 545

EE 546: Field-Effect Devices

3 Credits

The physical background, characteristics, and limitations of surface field-effect and junction field-effect devices and related structures.

Prerequisite: E E 442

EE 547: Dielectric Devices

3 Credits

Applications of insulator physics and devices based on insulator properties.

Prerequisite: E E 442

EE 549: Acoustic Wave Devices

3 Credits

Examines materials commonly used for acoustic wave devices, fundamentals of acoustic waves and resonance modes, and characteristics of these devices. E E 549 Acoustic Wave Devices (3) E E 549 is an elective in the field of electronic and photonic materials. Solid state acoustic wave devices based on piezoelectric, ferroelectric, and microelectromechanical systems (MEMS) have a broad range of applications including chemical and biological sensors, electromechanical sensing and transduction, resonators and wave guides for material characterization and health monitoring, filters in telecommunication systems, and optic communications. The course will cover commonly used materials and phenomena for acoustic wave devices, characteristics of different waves and vibration modes, device configurations, their main characteristics and applications, as well as design considerations. Students will learn the key features and materials commonly used for acoustic wave devices, main acoustic mode and their characteristics, important device configurations, the equivalent circuits for acoustic wave modes and devices, and examples of the device applications. Students will also acquire basic skills in selecting acoustic wave devices for specific applications, in designing and characterizing acoustic wave devices for different applications, and in finding suitable available materials and/or phenomena for the acoustic wave device. This course will count as an elective for electrical engineering students in the

electronics and photonics sub-discipline. Students wishing to take this course should be familiar with electronic circuit design and solid state devices.

Prerequisite: E E 310 and E E 442

EE 550: Foundations of Engineering Systems Analysis

3 Credits

Analytical methods are developed using the vector space approach for solving control and estimation problems; examples from different engineering applications. E E (M E) 550 Foundations of Engineering Systems Analysis (3) This 3-credit course is offered at the first-year graduate level and provides a systems-theoretic background for more advanced graduate courses in the disciplines of engineering and science. The course uses the vector space approach to develop the analytical foundations for solutions of science and engineering problems in diverse application areas such as optimal control, estimation, and signal processing. First, the theoretical foundation of vector spaces, function spaces, and Hilbert spaces are developed. Linear transformations are then introduced, followed by the Reisz-Frechet theorem and Hahn-Banach theorem, with applications to optimization problems. Spectral analysis is then covered. Finally, diverse applications of these various techniques are presented throughout this course to illustrate the wide range of engineering problems that can be solved using the vector space approach.

Prerequisite: MATH 436

Cross-listed with: ME 550

EE 551: Wavelets and Sparse Signal Representations

3 Credits

Recommended Preparations: Linear algebra This course provides the foundation to understand and use wavelets and sparse signal representations. In particular, it develops sparse representations as an evolution of the discrete wavelet transform. Students will recognize, identify, and apply sparse and wavelet representations methodology to specific signal processing projects. Students will be shown multiple real world applications within this area and guided to apply the methodologies combined with their own domain knowledge.

Prerequisite: EE 453

EE 552: Pattern Recognition and Machine Learning

3 Credits

This course is a comprehensive overview of the fields of pattern recognition and machine learning. The content covers both classification and recursion, model selection, decision theory, information theory, linear and non-linear models, graphical models, kernel methods, mixture models and EM as well as neural networks. It assumes no previous knowledge of pattern recognition or machine learning concepts. Knowledge of multivariate calculus and basic linear algebra is required, and some familiarity with probability would be helpful.

Recommended Preparations: Multivariate calculus, linear algebra, probability

Cross-listed with: CSE 583

EE 553: Topics in Digital Signal Processing

3 Credits

Parametric modeling, spectral estimation, efficient transforms and convolution algorithms, multirate processing, and selected applications involving non-linear and time-variant filters.

Prerequisite: E E 453

EE 554: Topics in Computer Vision

3 Credits

Discussion of recent advances and current research trends in computer vision theory, algorithms, and their applications.

Prerequisite: CMPEN454 or E E 454

Cross-listed with: CSE 586

EE 555: Digital Image Processing II

3 Credits

Advanced treatment of image processing techniques; image restoration, image segmentation, texture, and mathematical morphology.

Prerequisite: CMPEN455 or E E 455

Cross-listed with: CSE 585

EE 556: Graphs, Algorithms, and Neural Networks

3 Credits

Examine neural networks by exploiting graph theory for offering alternate solutions to classical problems in signal processing and control.

EE 557: Multidimensional Signal Processing

3 Credits

Multidimensional sampling, weak causality, recursibility, multidimensional transforms, stability, global and local state-space models, multidimensional filters, and multidimensional spectrum estimation.

Prerequisite: E E 453

EE 559: Wireless and Mobile Sensing in the Age of IoT

3 Credits

This course covers state-of-the-art research on Internet of Things (IoT), with a focus on wireless networking and mobile sensing. Topics of discussion include high precision localization, GPS, smart healthcare, autonomous vehicles and drones, Augmented/Virtual Reality, Battery free communication, 5G basics, Security etc. The course begins with a basic background in linear algebra, signal processing, wireless communications in the context of applications. Thereafter, the topics will be organized into various applications and research from top notch conferences will be presented. In addition, within each application, the appropriate background and common principles underlying Bayesian Filtering, Maximum Likelihood, Sensor design basics etc will be emphasized.

Recommended Preparations: Programming skills are required. Ability to program in any programming language is fine.

Cross-listed with: CSE 559

EE 560: Probability, Random Variables, and Stochastic Processes

3 Credits

Review of probability theory and random variables; mathematical description of random signals; linear system response; Wiener, Kalman, and other filtering.

Prerequisite: E E 350 ; STAT 418

EE 561: Information Theory

3 Credits

Mathematical measurement of information; information transfer in discrete systems; redundancy, efficiency, and channel capacity; encoding systems.

Prerequisite: E E 460 ; STAT 418

EE 562: Detection and Estimation Theory

3 Credits

Detection decision theory, Bayes and Neyman-Pearson criteria, optimal receivers, classical estimation theory, signal-noise representations, optimum linear signal parameters estimation.

Prerequisite: E E 560

EE 564: Error Correcting Codes for Computers and Communication

3 Credits

Block, cyclic, and convolutional codes. Circuits and algorithms for decoding. Application to reliable communication and fault-tolerant computing.

Prerequisite: Communication Networks

Cross-listed with: CSE 554

EE 565: Reliable Data Communications

3 Credits

Discussion of problems and solutions for ensuring reliable and efficient communication over wired and wireless links and data networks.

Prerequisite: Communication Networks; STAT 418

Cross-listed with: CSE 515

EE 567: Wireless and Mobile Communications

3 Credits

Development of key wireless networks systems analysis and design tools utilizing telecommunications principles; current and emerging mobile wireless techniques. E E 567 Wireless and Mobile Communications (3) E E 567, Wireless and Mobile Communications, extends basic principles of communications systems and their associated performance into the world of wireless and mobile communications. This course has been designed primarily to provide a good understanding of fundamental problems and counter-measure techniques in digital communications over dispersive wireless mobile channels. It starts with a review of material necessary for advanced study in wireless communications: current wireless mobile systems and standards, frequency reuse and the cellular concept, co-channel interference and noise, receiver sensitivity and link budget calculations, coverage, and spectral efficiency and

capacity. Next, various types of propagation modeling are presented, such as large-scale fading, small-scale fading, and multiple scattering (multi-path) phenomena. Examples of Rayleigh, Rician, and Nakagami fading channels are discussed, and level crossing rates and fade durations are determined. This is followed by methods for developing laboratory fading channel simulators for both single- and multiple-path channel models, including the laboratory simulation of shadowing. Conventional path-loss models in macro-cells such as Okumura-Hata and outdoors micro-cells, COST231-Hata, and Walfish-Ikegami models as well as path loss for indoor micro-cells are then detailed. The next part of the course covers fundamental limits introduced by co-channel interference, as multiple lognormal interferers are introduced. Specifically, Fenton-Wilkinson, Schwartz and Yeh, Farley's methods and a numerical comparison are presented. Outage probability evaluation is detailed. Modulation techniques used in wireless mobile applications and associated performance over fading channels are reviewed next, followed by a detailed investigation of diversity and combining techniques. TDMA and CDMA Cellular systems are presented next. Topics covered here include: Spread spectrum systems including direct sequence, frequency hopping, fading channel applications, RAKE receiver concepts, multi-input-multi-output (MIMO) systems using antenna arrays, space-time coding and BLAST systems. As examples of mobile cellular architectures, TDMA (GSM) and CDMA cellular systems are covered. Finally, in order to initiate hard or soft handoffs, link quality measurement techniques are discussed. Optimal resource allocation in terms of channel assignment techniques are presented and analyzed. Students will be evaluated by means of assignments (25%), a mid-semester examination (35%), and a final examination (40%). The course will be offered every other spring, with an anticipated enrollment of 15-30 students.

Prerequisite: E E 460 ; E E 560

EE 568: Digital Communications I

3 Credits

Linear and nonlinear digital modulation techniques; performance in additive Gaussian noise channel; continuous phase modulation; carrier acquisition and recovery.

Prerequisite: E E 460; Concurrent: E E 560

EE 569: Digital Communications II

3 Credits

Baseband pulse transmission; baseband systems optimization; bandlimited channels performance in ISI; equalization; MLSE and ISI; fading channels; diversity; CDMA.

Prerequisite: E E 560 ; E E 568

EE 573: Constitution of the Ionosphere

3 Credits

Properties of neutral and ionized atmosphere above 60 km; photochemical processes; solar, meteoric perturbations of the ionosphere; large-scale movements in ionization.

EE 574: Propagation Through Random Media

3 Credits

RF/optical wave propagation through turbulent, turbid, and heterogeneous media (atmosphere/ionosphere/sea). Impacts and mitigation discussed for various scenarios.

Prerequisite: E E 430 or E E 439 or E E 477 or PHYS 457

EE 576: Inversion Techniques in Remote Sensing

3 Credits

Introduce skills to address a wide variety of inverse problems such as found in atmospheric sensing, geosciences, and acoustics.

Prerequisite: E E 430 or E E 439 or E E 477 ; STAT 418

EE 578: Radar Systems

3 Credits

This course provides a general understanding of radar systems at the graduate level, building upon material covered in undergraduate courses in electromagnetics, signals and systems, and antenna theory. In particular, it investigates the theory of radar systems and subsystems, and continues with the analysis of the radar equation, target detection in noise, and clutter phenomena. It includes radar techniques to enhance high range resolution of targets such as pulse compression. It also considers radar tracking, synthetic aperture radar, radar polarimetry, target recognition, scattering process, radar signal processing, electronic counter-measure techniques, and laser radar. Building on these concepts, students will understand the usage and applications of various types of radar system designs. Students will understand propagation, multi-path, and clutter phenomena and their effects on radar system performance. Students will recognize, identify, and apply proper radar techniques and apply these techniques to a variety of remote sensing radar applications.

EE 430 and (EE 432; EE 438; EE 439) and (EE 453; EE 460)

EE 579: Microwave Radar Remote Sensing

3 Credits

Scientific and engineering principles of microwave radar remote sensing of land, sea, and the atmosphere.

Prerequisite: E E 430 or E E 438 or E E 439 or E E 473

EE 580: Linear Control Systems

3 Credits

Continuous and discrete-time linear control systems; state variable models; analytical design for deterministic and random inputs; time-varying systems stability.

Prerequisite: E E 380

EE 581: Optimal Control

3 Credits

Variational methods in control system design; classical calculus of variations, dynamic programming, maximum principle; optimal digital control systems; state estimation.

Prerequisite: E E 580

EE 582: Adaptive and Learning Systems

3 Credits

Adaptive and learning control systems; system identification; performance indices; gradient, stochastic approximation, controlled random search methods; introduction to pattern recognition.

Prerequisite: E E 580

EE 584: Robust Control Theory

3 Credits

Fundamentals of Robust Control Theory with emphasis on stability, performance analysis, and design.

Prerequisite: E E 580 or M E 555

Cross-listed with: ME 558

EE 585: Convex Optimization

3 Credits

This course is designed to provide students with necessary skills to recognize or build convex optimization problems coming from diverse application areas and to solve them efficiently. It consists of five parts: 1) convex sets, 2) convex functions, 3) convex optimization, 4) algorithms and 5) real life applications. In the first part, important examples of convex sets will be given and the operations that preserve convexity of sets will be discussed. The second part will focus on convex functions, their basic properties, and the operations that preserve convexity of functions. In the third part, which is built on the first two parts, convex optimization problems will be formally introduced along with important examples ranging from linear and quadratic to semi-definite programming; second, Lagrange duality and optimality conditions will be covered. The fourth part will focus on the algorithms to solve convex problems and on their computational complexity. In the fifth part, various applications will be covered.

Prerequisite: IE 505

Cross-listed with: IE 585

EE 586: Power Systems Dynamics, Stability, and Controls

3 Credits

This course provides a broad exploration of the principles of dynamics, stability, and control of power systems. In particular, it focuses on the angle stability aspect. It will cover dynamic modeling requirements of synchronous generators and dynamic load modeling for stability studies, modeling of generator excitation systems, different types of system stability, modeling and analysis of sub-synchronous oscillations, and some selected special topics relevant to modern power systems. Basic notions of Lyapunov stability will be briefly described. The synchronous generator modeling in rotating d-q-0 frame will be presented along with different degree of simplifications, magnetic saturation models, DC and AC excitation system modeling, and corresponding per unit systems. Integration of such models for stability study of multimachine system will be analyzed. Detailed treatment of small-signal stability analysis for a single-machine-infinite-bus system including the effect of excitation systems and design of power system stabilizers will be presented followed by special techniques to analyze small-signal stability of large-scale multi-machine systems. Numerical integration methods for solving

the initial value problem of governing differential and algebraic equations describing power system dynamics will be described in the context of transient stability simulations followed by direct method of transient stability analysis. Fundamentals of subsynchronous oscillations and methods for corresponding stability analysis will be discussed. Finally, dynamic modeling of wind generation and VSC HVDC transmission system will be very briefly introduced.

Prerequisite: EE 488

EE 587: Nonlinear Control and Stability

3 Credits

Design of nonlinear automatic control systems; phase-plane methods; describing functions; optimum switched systems; Liapunov stability; special topics in stability.

Prerequisite: E E 380

Cross-listed with: ME 559

EE 588: Power System Control and Operation

3 Credits

Steady-state and dynamic model of synchronous machines, excitation systems, unit commitment, control of generation, optimal power flow.

Prerequisite: E E 488

EE 589: Smart Grid Control and Dynamics

3 Credits

This course covers the application of advanced power electronics in power apparatus. The first step is to understand the design of power electronics systems for smart grids. The course starts with an overview of DC/DC converters and covers the controller design for DC/DC converters. Next, voltage source converters and control designs for voltage source converters are covered. Electrical machines are the main components of the smart grid system. Therefore, operation and modeling of AC machines are very important in modern smart grid systems. The additional topics to be covered in this course are: simplified model of an induction machine connected to the grid, modeling and analysis of doubly fed induction generators used in wind farms, modeling and control of permanent magnet synchronous machines, and modeling and analysis of transformers. Next, an overview of mathematical modeling of solar energy systems is provided and different control methodologies are discussed. Next, the state space modeling is covered and the concepts of eigenvalue analysis, Bode plots, and Nyquist stability criterion are implemented to analyze different generation units. Impedance modeling is another technique used to investigate the interactions between renewable energy sources and grids. The basics of impedance modeling technique are covered and case studies are defined to derive the impedance of voltage source converters in smart grids. Dynamic phasor modeling is another technique used to investigate the stability of a dynamic system, especially in unbalanced systems. The main components of dynamic phasor modeling are discussed and an analysis approach is covered to model renewable energy sources in smart grids.

EE 594: Research Projects

1-9 Credits/Maximum of 9

Supervision of individual research projects leading to M.S. or M.Eng. papers. Written and oral reports are required.

EE 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects including non-thesis research which are supervised on an individual basis and which fall outside the scope of formal courses.

EE 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

EE 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

EE 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

EE 602: Supervised Experience in College Teaching

3 Credits/Maximum of 6

College Teaching Experience

EE 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

EE 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

EE 897: Special Topics

1-9 Credits/Maximum of 9

Formal course given on a topical or special interest subject with a professional orientation that may be offered infrequently.

Energy and Geo-Environmental Engineering (EGEE)

EGEE 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

EGEE 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

EGEE 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

EGEE 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Supervised experience in teaching and orientation to other selected aspects of the profession at The Pennsylvania State University.

Energy and Mineral Engineering (EME)

EME 501: Design Under Uncertainty in Energy and Mineral Systems

3 Credits

This class is designed to present a broad range of tools for evaluating energy projects, technologies, and systems. Topics will include project evaluation methods (NPV, discounting), tools for decision/design under uncertainty (Monte Carlo simulation, decision trees, lattices, real options), optimization (linear programming, stochastic programming), and economics/markets/regulation (review of microeconomics, market failures, regulation, and market design). Students will focus both on the intuition and appropriate application of the various methods and theories.

EME 504: Foundations in Sustainability Systems

3 Credits

Theoretical background of sustainability issues and studies of sustainability systems.

EME 511: Interfacial Physical-Chemical Systems, Processes, and Measurements

3 Credits

The boundary between two phases, the interface between the phases (referred to as the "interface") has very different properties from that of the bulk phase and such interfaces are important in a variety of energy, chemical, and mineral engineering processes. The interface may control transport between the phases, e.g., liquid-liquid extraction, reaction at the interface, e.g., heterogeneous catalysis, or accumulation of a component from one of the bulk phases, e.g., adsorption. All of these are examples of interfacial phenomena relevant to energy conversion, mineral extraction, and oil recovery processes. Course topics are drawn from physical and interfacial chemistry to address engineering and applied science needs in fuel science, fossil fuel recovery, renewable fuel processing, mineral processing, environmental science, and health. Topics include interfacial forces, phase behavior, adsorption/desorption, reaction kinetics, and solution chemistry. The applications of these subjects in various fields such as reservoir engineering, fuel science, mineral separations, reacting flows, and water systems will also be covered. Analytical surface

characterization techniques and particle sizing methods will also be covered, including selected demonstrations.

EME 521: Mathematical Modeling of Energy and Mineral Systems

3 Credits

This class develops the understanding of methods of modeling used for important physical and chemical phenomena involved in energy and mineral engineering systems. These include both separate and mixed solid (solid mechanics) and fluid (computational fluid mechanics) systems, including reactive components. The emphasis is on finite element methods but also includes other continuum methods (LBM, SPH), integral methods, and discontinuum methods. Students will develop working programming modules of simple-through-complex models of interactive physical systems and research materials on some form of computational methods.

Prerequisite: EGEE 510

EME 522: Computational Methods for Electric Power Systems Analysis

3 Credits

This course covers the formulation of and solution methods for a full range of economic-engineering investment and operations problems for electric power systems. Application problems include economic dispatch, unit commitment, optimal power flow, generation capacity expansion, transmission expansion, and modeling of competitive electricity markets. Solution methods include linear programming, mixed integer programming, decomposition methods for stochastic programming (e.g., Lagrangian Relaxation, Benders Decomposition), and mixed complementarity problems, with an emphasis on numerical implementation.

RECOMMENDED PREPARATIONS: It is recommended that students be familiar with or have taken EME 501, IE 505, or an equivalent graduate-level course in math programming.

EME 523: Stochastic Optimization Methods of Energy and Environmental Systems

3 Credits

This course covers the theory and implementation of computational methods for stochastic simulation and stochastic optimization, with an emphasis on algorithms and implementation. The course emphasizes the quantitative analysis or numerical modeling of complex systems in fields such as civil, environmental, energy, mechanical, and industrial engineering or energy, environmental, and natural resource economics. Topics include Monte Carlo simulation, quasi-random and pseudo-random sampling methods, Markov Chains, Dynamic Programming, Approximate Dynamic Programming, and Stochastic Programming decomposition techniques.

RECOMMENDED PREPARATIONS: It is recommended that students be familiar with or have taken EME 501, IE 505, or an equivalent graduate-level course in math programming.

EME 524: Machine Learning for Energy and Mineral Engineering Problems

3 Credits

This course provides an overview of the application of machine learning algorithms to problems in energy and mineral engineering. The course addresses the strengths and weaknesses of various machine learning

approaches, as well as appropriate testing and validation techniques for these complex models. Topics include machine learning applications in regression, classification, design optimization, and risk analysis. An emphasis of this course is for students to apply these methods to specific research problems of interest. Students with some background in statistics, but no previous formal training in machine learning algorithms will find this course most useful.

RECOMMENDED PREPARATIONS: Students are recommended to have had some previous basic training in statistics and experience with at least one programming language.

EME 525: Theory and Practice of Policy Analysis for Engineers

3 Credits

The course provides a broad introduction to analytical methods commonly used in science, technology, and energy policy analysis.

EME 526: Solar Utility and Portfolio Management

3 Credits

EME 526 covers the theoretical frameworks and quantitative methods for evaluating and designing solar resource projects. Methods will include quantitative solar resource measurement, forecasting, uncertainty quantification, dynamical systems modeling, and game theoretic models. Students will compare and assess alternative theoretical and quantitative approaches in terms of their ability to address a range of important objectives, including economic, technical constraints, robustness to uncertainty, varying risk preferences of stakeholders, and other ethical and cultural considerations. The course utilizes data sets and modeling resources drawn from actual case studies to provide students context in which to apply and evaluate the methods.

EME 527: Stochastic Modeling of Spatial Variability in Energy and Environmental Systems

3 Credits

This course covers the theory, methods, and implementation of modeling spatial variability and uncertainty with special consideration of the structure of energy, natural resource, and environmental system models. The course draws heavily upon geostatistical methods, and covers random functions, Semivariograms, Kriging, spatial simulation, and data assimilation into spatial simulation models.

EME 531: Thermodynamics of Energy and Mineral Systems

3 Credits

This course presents linear and non-linear irreversible thermodynamics as a means to explore the coupling between physicochemical, kinetic, and transport processes. Linear irreversible thermodynamics will be illustrated by well-known and practical phenomena such as Seebeck effect (thermocouple), Peltier effect (dehumidifier), Soret effect (thermal diffusion), etc. Non-linear irreversible thermodynamics will be used for demonstrating the phenomena of bifurcation, self-organization, and dissipative structures that take place in nature and human society. The self-organizing economy will also be discussed to show how the far-from-equilibrium thermodynamics can be applied to some economic phenomena.

EME 541: Electrochemical Science and Engineering Fundamentals

3 Credits

Fundamentals of electrochemical science and engineering based on electrochemical thermodynamics and kinetics. EME 541 Electrochemical Science and Engineering Fundamentals (3) The course focuses on the fundamental concepts of electrochemical science and engineering based on thermodynamics and kinetics. The course provides a synopsis of a variety of electrochemical systems and processes and shows their applicability for a number of industrial applications.

EME 551: Safety and Environmental Risk Analysis for Energy and Mineral Engineering Systems

3 Credits

In the energy and minerals sector, environmental health and safety (EHS) concerns have critical importance to engineering design, operations, and applied research. Contemporary experience has demonstrated that the integration of these priorities into the conceptualization, design, development, and management of energy and mineral technologies is essential. This course will begin with an overview of quantitative analytical techniques to assess probabilistic risks that arise due to the design and maintenance of engineered systems. The balance of the course will be devoted to study of effective approaches to analyzing, mitigating, and managing risk, environmental impacts, behavioral/psychological dimensions (e.g., cognitive biases), and the application and validation of interventions to achieve goals. The intent of this course is to give students an understanding of the challenges and successful approaches that should be part of every engineering project and operation.

Recommended Preparations: Students enrolling in this course are recommended to have acquired previous experience or training in probability and statistics.

EME 570: Catalytic Materials

3 Credits

Preparation and characterization of solid catalytic materials and the relationships between their surface, defect, and electronic properties and catalytic activity. MATSE (EME) 570 Catalytic Materials (3) This course covers the preparation and characterization of solid catalytic materials, and the relationships between the surface and electronic properties and pore structure of the materials and their catalytic activity and selectivity. The course includes the following materials: zeolites and molecular sieves; metals and alloys; metal oxides; metal sulfides; and other catalytic materials. Also included are the major applications of catalytic materials in chemical and petroleum industries and in other manufacturing industries for environmental protection. This course can be grouped into three parts: (1) introduction to catalysis and analytical techniques; (2) synthesis and characterization of catalytic materials; and (3) catalysis at surfaces of solid materials. The course is suitable for a broad spectrum of students in energy and mineral engineering, materials science and engineering, fuel science, chemical engineering, chemistry, solid-state science, and environmental engineering.

Prerequisite: CHEM 452 or similar course in chemical, materials or energy sciences and engineering
Cross-listed with: MATSE 570

EME 580: Methodology of Research in EME

3 Credits

Analysis of the methodology of the research process through a discussion of the methodology of reading and writing peer-reviewed publications. The students will learn how to more efficiently understand and explain the results available in the published literature, so that they can apply this methodology to organize, present, and discuss their own results by applying the essential principles of research ethics and integrity.

Prerequisite: EME 500

EME 581: Research and Geostatistics Methods

3 Credits

Presents methods essential for the conduct and analysis of scientific research and spatial characterization in energy and mineral engineering disciplines.

EME 589: Management and Design of Renewable Energy and Sustainability Systems

3 Credits

Most professional opportunities within renewable energy and sustainability systems require working in interdisciplinary teams on complex problems. This course will use a case-study approach to provide realworld management, and leadership, and research experiences and utilize the technical, economic, and ethical concepts learned in other course work in the field of renewable energy and sustainable systems (RESS). Following an intensive session on project management, team dynamics, and leadership, students will identify a team and external company or another stakeholder with a challenge relevant to the program. The teams will then conduct research evaluate alternatives, assess feasibility, and complete a detailed techno-economic analysis for their case. This analysis will serve as a platform from which to define sustainability metrics, evaluate alternatives, and assess feasibility and complete life-cycle and environmental impact analysis as part of the final design. Projects outcomes will be presented to both external stakeholders, and peers, and program faculty for constructive feedback that will be incorporated in the project final report.

Prerequisite: EME 504 , EME 801 , EME 802 , and BIOET533

EME 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars that consist of individual lectures by faculty, students or outside speakers on energy and mineral engineering issues.

Cross-listed with: PNG 590

EME 596: Individual Studies

1-9 Credits/Maximum of 12

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

EME 597: Special Topics

1-9 Credits/Maximum of 12

Formal courses given on a topical or special interest subject which may be offered infrequently.

EME 597B: Geomechanics

2 Credits

Discussion of current and foundational research contributions in Geomechanics including ongoing work by current students

EME 597C: Creating University/Industry Collaboration

2 Credits

This course will provide students hands-on experience designing research programs to address external market needs that will lead to enhanced Penn State / external collaboration. Classroom lectures will cover topics important for design a new technology program.

EME 600: Thesis Research

1-15 Credits/Maximum of 999

Thesis research culminating into the doctoral degree in Energy and Mineral Engineering.

EME 601: Thesis Preparation

0 Credits/Maximum of 999

Thesis research after successful comprehensive exam culminating into the doctoral degree in Energy and Mineral Engineering.

EME 801: Energy Markets, Policy, and Regulation

3 Credits

Structure and function of energy markets; existing and emerging environmental regulations; decision-making by energy companies.

EME 802: Renewable and Sustainable Energy Systems

3 Credits

An overview of renewable energy technologies and sustainable energy system analysis.

EME 803: Applied Energy Policy

3 Credits

Provides in-depth exploration of energy policy development, implementation, and assessment at multiple governmental and corporate scales with emphasis on energy markets.

EME 805: Renewable Energy and Nonmarket Enterprise

3 Credits

Industry perspective on the resources, technologies, engineering approaches and externalities involved in deploying renewable energy businesses profitably and sustainably.

EME 807: Technologies for Sustainability Systems

3 Credits

This course examines strategies and applications of sustainable technologies in manufacturing, energy, water, transportation, food, and building systems.

EME 810: Solar Resource Assessment and Economics

3 Credits

Methods, economic criteria, and meteorological background for assessing the solar resource with respect to solar energy conversion technologies.

EME 811: Solar Thermal Energy for Utilities and Industry

3 Credits

Applications of solar thermal energy (STE) including district heating/cooling (buildings), industrial process heating, fuel synthesis, desalination, and materials processing.

Prerequisite: EME 810**EME 812: Utility Solar Power and Concentration**

3 Credits

Technical and theoretical background for utility scale solar energy conversion technologies to generate electric power.

Prerequisite: EME 810**EME 897: Special Topics**

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject with a professional orientation that may be offered infrequently; several different topics may be taught in one year or semester.

Energy, Environmental, and Food Economics (EEFE)

EEFE 510: Econometrics I

3 Credits

Econometrics is concerned with using aspects of economic theory, mathematics, and statistical inference to analyze economic phenomena and relationships. This course approaches econometrics with three broad considerations: 1. The role of econometrics in theoretical and applied economics; 2. The theoretical basis of econometrics; 3. The applied use of econometrics. Topics include general linear model, multicollinearity, specification error, autocorrelation, heteroskedasticity, restricted least squares, functional form, dummy variables, limited dependent variables.

Prerequisite: ECON 490; STAT 462; STAT 501**EEFE 511: Econometrics II**

3 Credits

Econometrics II builds on the foundations of EEFE 510 to provide students with a good understanding of econometric methods that are

frequently used in the empirical literature. Topics include endogeneity and moment-based estimators, linear systems of equations, maximum likelihood estimation, models for qualitative and limited dependent variables, models for time series data, models for panel data and treatment evaluation. This course is geared towards students who are interested in conducting empirical research on topics in applied economics and related fields.

Prerequisite: EEFE 510

EEFE 512: Applied Microeconomic Theory I

3 Credits

This course covers basic principles of microeconomic theory with the use of calculus. The emphasis is on applied theory and problem solving, rather than formal proofs and derivations. By developing knowledge of microeconomic theory and economic reasoning skills, the goal of the course is to provide a foundation for more advanced courses and for applied research at the graduate level. Students who successfully complete this course should understand and be able to apply the microeconomic theory needed to solve applied economic problems in the following areas: Consumer choice and demand; Producer choice and supply; Choice under uncertainty; Strategic decision-making (game theory); The functioning of competitive and monopolistic markets; General equilibrium and welfare analysis.

EEFE 519: Resource and Environmental Economics I

3 Credits

This course gives students an overview of essential theories and methods used in the economic analysis of natural resources. Objectives are to provide students with a command of theory and methods needed to teach the field and to conduct contemporary research. Topics include dynamic resource systems; dynamic optimization; nonrenewable resource theory; the Hotelling model; stock pollution externalities; common property; and option values.

Prerequisite: EEFE 512; ECON 502

EEFE 527: Quantitative Methods I

3 Credits

This is a course in quantitative economics and its applications, with heavier emphasis on linear models and how they relate to microeconomic theory in both static and dynamic settings. The first part of the course reviews the foundations of the mathematical analysis with the goal of modeling feasibility; i.e., the set of possible choices. This prepares us to next move to modeling the optimal choice with an extended presentation on optimization theory and application in the static setting. The final part of the course moves on to the methods for engaging in dynamic optimization.

Prerequisite: EEFE 512; ECON 502

EEFE 529: Foundations of Economic Welfare Analysis

3 Credits

How do we know which forms of economic organization are preferred to others? How do we evaluate who wins and loses within the economic sphere? How do we know when the allocation of goods and services by the economic system is societally optimal? How do we define what is societally optimal? When do government policies improve societal

welfare and when do they worsen it? How do we measure societal welfare? When should governments intervene in the economic system and to what extent? How large should the economic system be relative to the natural system? How much should present generations consume relative to future ones? Welfare economics is a branch of economics that seeks to answer these questions. In this course we will develop the concepts and tools needed to do so. Our primary focus will be on evaluating the efficiency and equity implications of public policies using modern theory and empirical methods. In the first part of the course we review the ways in which we can and cannot quantify the welfare of economic agents. We begin by reviewing the foundations of microeconomic theory which we use to analyze how the welfare of economic agents is altered due to exogenous changes in prices and/or income. Using these welfare measures, in the second part of the course we examine how public policies affect the welfare of economic agents using tools from public finance. Since our ultimate goal is applying welfare theory to empirical questions we will also review in part the empirical methods and tools required for conducting state of the art research in this area.

Prerequisite: ECON 510, ECON 512

EEFE 530: Applied Microeconometrics II

3 Credits

This course is designed to: (1) expose students to the most common econometric and statistical techniques used in applied microeconomic research and (2) give students an overview of the different types of micro data and the most common methods used to manipulate these data to create additional data sets and variables. The course is divided into three broad parts. The first part of the course focuses on computational, data, and methodological issues. The second and third parts of the course are divided equally between reduced-form/treatment effects methods and structural choice models and methods and other nonlinear structural and quasi-structural models. Each of the topics in the second and third part make use of the methods learned in the first part.

Prerequisite: EEFE 512, EEFE 510

EEFE 531: Applied Microeconometrics I

3 Credits

In this course, we will study microeconometrics, a subfield that encompasses specification as well as a variety of estimation, computational, and simulation methods that allow us to pursue specification and parameterization of econometric models suitable for analyzing micro-level data. We will see that these methods support an enriched basis for examining the validity of microeconomic theory, and also extend the analytics feasibly tackled by microeconomics. At the micro-level of empirical analysis, we will see our theory predicts high frequencies of corner solutions, abrupt switching, and discontinuities. In each case, these predictions are also apparent in micro data. Together, these conditions call for methods that go beyond simple continuous choice functions and equilibria often found adequate for aggregate static and dynamic modeling. Knowledge of these new methods is essential to empirical learning in most areas of contemporary applied microeconomics. These methods evolved to support the active application of microeconomic theories of micro-level behavior (e.g. discrete choice, corner solutions, cusps in dynamic paths) as well as to address peculiar features of micro-level data such as error-in-measurement, availability of only binary or polychotomous indicators of continuous variables, and substantial heterogeneity. Theory is relied upon

to specify models prior to estimation, to specify characteristics of data sets, and to interpret results.

Prerequisite: (EEFE 512; ECON 502) and (EEFE 510; ECON 501) and (EEFE 511; ECON 510)

EEFE 532: Applied Computational Economics

3 Credits

Economists often find themselves in situations where closed-form solutions do not exist or econometric estimation is inappropriate due to data limitations or the nature of the problem. In these cases, numerical approaches, using computer-based methods, may be an economist's best option. In this course, we will explore four topics in the field of computational economics: computable general equilibrium modeling, growth modeling, uncertainty and formal monte carlo analysis, and agent-based modeling. The overall goal of this course is to provide students with an in-depth understanding of computational economics so that they are prepared to build unique mathematical models to address complex situations that have not yet been encountered. Students should have successfully completed a graduate-level course in microeconomic theory prior to enrolling in this course.

Prerequisite: EEFE 512

EEFE 535: Empirical Analysis in Food Marketing

3 Credits

This is the first course in the Ph.D. field sequence in Industrial Organization, including applications to food marketing. Industrial Organization is the applied study of firms and markets. IO typically focuses on differences across firms and markets, implying the need for a rich set of models. The course presents a series of models of increasing realism and complexity. At each stage, we review the relevant theory as a starting point and then do a detailed study of the empirical application of that theory to real world data with a discussion of the implications for economic policy in areas such as anti-trust, and environmental and food policy analysis.

Prerequisite: EEFE 512, EEFE 510

EEFE 536: Economics of Food Behavior and Health

3 Credits

A course in microeconomic consumer theory and estimation, and other economic approaches to consumer behavior, including applications to food and health. The core of the course will involve the microeconomic theory of the consumer and demand estimation. However, other topics relevant to consumer/household behavior may be discussed, such as Duality Theory, Integrability, Function Forms (Linear Expenditure System, Linear Demand, AIDS model, Translog Model, Rotterdam Model, EASI), Price Indices, Flexibility, Incorporating Demographics and Equivalence Scales, Separability, Intertemporal Choice, Household Production, Intrahousehold Allocations, Zeroes Problem, Aggregation, Savings Decisions, Behavioral/Neuroeconomics, Labor Supply, Hedonic Models, Useful Data Sets.

Prerequisite: (EEFE 510; EEFE 511; ECON 521) and EEFE 512

EEFE 541: Resource and Environmental Economics II

3 Credits

This course is designed to give students an overview of the field of Environmental Economics. The objectives of this course are to provide students with a basic understanding of the theoretical and methodological foundations used in Environmental Economics, and to explore recent advances in areas of contemporary policy interest.

Prerequisite: EEFE 511, EEFE 512

EEFE 550: International Economic Development and Agriculture

3 Credits

This course applies economic analysis to problems of economic development and growth. The course covers the economics of traditional (Malthusian) societies, transitions to modern economic growth, fertility and population growth, investments and intergenerational transmission in human capital, human capital and economic growth, and internal migration and structural transformation. Students who successfully complete this course will be able to demonstrate understanding of, articulate, and use in their own research economic models, theories, and applied research in these topics related to developing countries.

Prerequisite: EEFE 510, EEFE 512

EEFE 590: Colloquium

1-3 Credits

Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

EEFE 600: Thesis research

1-15 Credits/Maximum of 999

Thesis research

EEFE 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

Ph.D. Dissertation Full-Time

Energy, Environmental, and Mineral Economics (ENNEC)

ENNEC 540: Economic Analysis of Energy Markets

3 Credits

This course uses economic analysis to explain the history of world energy and its regulation since 1945.

Prerequisite: ECON 502

ENNEC 560: Mineral and Energy Finance I

3 Credits

Introduction to theory of finance and application of financial tools to commodity market analysis. Emphasis on mineral and energy markets.

Prerequisite: approval of the department

ENNEC 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research which are supervised on an individual basis and which fall outside the scope of formal courses.

ENNEC 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

Engineering (ENGR)

ENGR 501: Engineering Leadership for Corporate Innovation

3 Credits/Maximum of 999

Traditional and contemporary leadership theory is analyzed to determine effective strategies for leading projects and innovation within an engineering context. This course focuses on concepts and theory related to the study of leadership in an engineering context. Traditional and contemporary leadership theory will be analyzed to determine effective strategies for leading technical projects and innovation. Based on current literature and research into effective engineering leadership, students will focus on understanding concepts related to: technical communication, optimization of engineering teams, and diffusion of innovation. Financial concepts and Lean Sigma practices will be assessed for effective engineering leadership decision-making. Specific topics addressed related to the engineering leadership concepts include leadership in organizations, communications in the workplace, customer focus in organizations, financial knowledge, workforce focus in organizations, and operational excellence. Students who successfully complete this course will be able to: distinguish leadership theory relevant to an engineering context; recognize commonalities of leaders in successful organizations; explain concepts for how innovation is diffused throughout a corporate culture; define communication concepts relevant for leading change in a diverse technical environment; and recognize the ethical and social implications of engineering work in a global environment. The overall objective for this course is to provide theoretical understanding and practice of leadership and innovation in technical contexts within the global business environment.

ENGR 502: The Smart City

3 Credits

This interdisciplinary course provides students with a "big picture" overview of the several engineering systems at work in our economy and society. The course is organized around the "smart city" because this umbrella topic allows students not only to explore multiple engineering systems in a single course but also to comprehend their connectivity. In other words, students will understand how a given engineering system functions not in isolation but in harmony with others. Towards this end, the course is structured around a handful of "mega themes": Cyber Engineering, Green Engineering Technology and Sustainability, Societal Systems Engineering, Living Systems Engineering, Cyber-Physical Ecosystems, and Physical and Digital Infrastructure. Though students may enter the course knowing almost nothing about a given mega theme, they will likely recognize familiar elements within it. That is because each mega theme encompasses the methods and knowledge bases of traditional fields: electrical, civil, computer, mechanical, and

environmental engineering as well as biology, public policy, sociology, information systems, and homeland security, to name a few. After successfully completing this course, students will be able to explain how diverse engineering systems work in concert in cities; identify the major methods used in each of the major engineering areas (electrical, mechanical, civil, etc.); analyze interdisciplinary scholarship in engineering; explain how scholars deploy methods and knowledge bases from two or more fields to solve problems in engineering; apply this knowledge by designing an interdisciplinary research project; and communicate a research plan clearly and effectively through a written proposal and oral presentation.

Recommended Preparations: BS degree in related field.

ENGR 503: Interdisciplinary Research Methods in Engineering

3 Credits

ENGR 503 is a practical course that teaches students how to conduct interdisciplinary research in engineering. It equips students with the skills and tools they need to undertake research projects of their own in anticipation of the dissertation. Specifically, the course teaches students how to ask a research question, develop a methodology that can answer it, engage in ethical research, locate and cite sources, and report findings using an appropriate language and format. The course is also designed to aid students in their professional development. Towards this end, it explains the role of grant seeking, academic conferences, and scholarly journals in engineering. In sum, students may enter ENGR 503 unsure of both how to produce scholarship on their own and how to share it with the academic community. They will exit the course ready to launch their own research projects with faculty guidance and communicate their findings at conferences and through publications.

ENGR 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

ENGR 594: Master's Paper Research

1-3 Credits/Maximum of 3

Investigation of a specific engineering problem and development of a scholarly written report in partial fulfillment of requirements for a master's degree in engineering.

ENGR 595A: Engineering Internship

1 Credits/Maximum of 4

ENGR 595A ENGR 595A Engineering Internship (1 per semester/ maximum of 4) This course will provide students with an opportunity to apply fundamental skills and academic concepts in a professional laboratory, industry, or government agency setting within the United States. The final grade (Pass/Fail) will be based on the final report submitted by the student, and by mid-point and final evaluations submitted by the employer. This course will be offered fall, spring, and summer, and may be repeated.

Full-Time Equivalent Course

ENGR 595I: International Engineering Internship

0.5-4 Credits/Maximum of 4

ENGR 595 ENGR 595I International Engineering Internship (1 per semester/maximum of 4) This course will provide students with an opportunity to apply fundamental skills and academic concepts in a professional laboratory, industry, or government agency setting outside of the United States. The final grade (Pass/Fail) will be based on the final report submitted by the student, and by mid-point and final evaluations submitted by the employer. This course will be offered fall, spring, and summer, and may be repeated.

Full-Time Equivalent Course

ENGR 596: Independent Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

ENGR 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

ENGR 597C: **SPECIAL TOPICS**

3 Credits

ENGR 599: Foreign Studies

1-12 Credits/Maximum of 24

Courses offered in foreign countries by individual or group instruction.

ENGR 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

ENGR 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No Description.

ENGR 610: Thesis Research Off-Campus

1-9 Credits/Maximum of 999

No description.

ENGR 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

Ph.D. Dissertation Part-Time

ENGR 802: Engineering Across Cultures and Nations

3 Credits

Explores cultural differences and impact on business practices and team dynamics working on virtual project teams with global partner

universities. Engineering Across Cultures and Nations is a core course in the Engineering Leadership and Innovation Management graduate program and focuses on the primary knowledge areas and essential competencies required for successful engineers to live and work in today's global marketplace. Within the context of engineering, the course will examine individual and cultural differences and how they impact communication and team dynamics. Students who complete the course will be able to understand sources of conflict that can arise from multicultural teams and effectively use the tools and resources discussed in class to manage individual and team motivation and minimize or effectively deal with conflict, while harvesting the benefits of diversity as they work on a real world virtual team project. Within an engineering context, students who complete this course will be able to: demonstrate a proficiency in team-building, leadership, and service; construct creative solutions to engineering issues incorporating cultural differences among team members, suppliers, and customers; critically analyze personal and team-member competencies and biases; formulate and apply strategies to improve team dynamics, compose effective feedback, recognition, motivation, and corrective guidance for international/intercultural team members; evaluate business opportunities within international and cross-cultural markets; and examine moral, ethical, and legal dilemmas in cross-cultural environments. These topics will be explored in an engineering context through engineering projects, guest lecturers, and discussions. The overall objective of this course is to provide students with a conceptual understanding of the impacts of multi-cultural influence on engineering problems and the leadership theory applicable for effective team performance.

ENGR 804: Engineering Product Innovation

3 Credits

Develop competencies for leading new product/process development or participating in corporate spin-outs using entrepreneurial skills within a corporation. This course focuses on the development of the competencies required to become a successful new product leader or corporate innovator within an engineering context. Course topics include: identification and development of the knowledge, skills, and attitudes of entrepreneurial leaders; fundamentals of corporate entrepreneurship; methods to leveraging intellectual property (IP); and development and use of the Business Model Canvas (BMC) for product development and commercialization. These topics are central to leading new product/process development within an existing engineering corporation. Upon successful completion of this course, students will be able to: describe the successful engineering leadership competencies of a corporate innovator, discuss and apply leadership strategies for leading innovation and creativity within engineering teams, analyze corporate innovation successes and failures and identify factors that play a role, outline the innovation management process and determine barriers to implementation inside the organization, define a successful new product launch using the Business Model Canvas (BMC), and describe the value of intellectual property and patent process to new product innovation within a corporation.

ENGR 805: ELIM Capstone Project

3 Credits

This course applies and integrates knowledge and skills gained throughout the ELIM program on a culminating project within existing organizations. The capstone course is designed to provide an opportunity to apply and integrate the knowledge and skills that were gained throughout the Engineering Leadership and Innovation Management

(ELIM) program with strategic management concepts. Capstone projects will target opportunities, problems, and challenges of an existing organization. After successfully completing this course, students will be able to: identify and assess the impact of opportunities and threats in a company, including its industry and its set of competitors; identify and assess a company's internal strengths and weaknesses and suggest alternative strategies; define the business-level strategies of the company; define competitors, competitive rivalry, competitive behavior, and competitive dynamics; and describe corporate-level strategy of a company. The overall objective of this course is to demonstrate integration of theories, knowledge, and application of leadership and innovation to the needs of a dynamic global marketing place.

Prerequisite: ENGR 408, ENGR 411

ENGR 810: Doctor of Engineering Praxis Research

1-12 Credits/Maximum of 24

This course provides Doctor of Engineering students with the opportunity to identify an applied research problem and develop a praxis research project to address the problem/question. Students will investigate the literature relevant to the selected area(s) of interest. Students will develop and implement a comprehensive praxis research project to address the problem. Students will also disseminate the results in both a scholarly presentation (final oral exam) and praxis (final praxis research document).

ENGR 820: Applied Engineering Research Methods

3 Credits

This research methods course focuses on the development of competencies required to become a successful professional researcher in engineering fields. While other courses will focus on an engineering topic and provide some insights into the associated research methods, this course aims to provide an overview of research methods used throughout engineering disciplines and provide guidance for when and why different methods should be employed in professional research practice. Students should come into the class with a research area defined and the class will provide students with a framework to conduct their own research through a pilot study and, thereby applying these methods to their professional practice. Course topics include: research ethics, literature review, problem framing, experimental design, qualitative and quantitative data analysis, and data presentation in professional engineering research fields. These topics are central to conducting effective engineering research. Students that complete this course will be able to: Define ethical requirements for application in engineering research; Critique and review literature to identify gaps for future work; Design and implement an experiment; Analyze and defend qualitative and quantitative results; Write and structure effective research papers; And report and defend research decisions and conclusions. Overall the objective of this course is to provide students with the tools to conduct research experiments and defend results in order to prepare them for research at the graduate level.

Recommended Preparations: A qualifying statistics or numerical methods course should be taken prior to enrolling or concurrently.

ENGR 888: Seminar for Engineering Teaching Assistants

1 Credits

Study of recently established knowledge and methodologies as applied to practice. Significant interaction among students and with instructor is expected.

ENGR 890: Colloquium

1-3 Credits/Maximum of 3

Continuing, professionally oriented seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

ENGR 896: Individual Studies

1-9 Credits/Maximum of 9

Creative projects with a professional orientation, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

ENGR 897: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject with a professional orientation that may be offered infrequently.

Engineering Design (EDSGN)

EDSGN 507: Systems Thinking

3 Credits

The theory and practice of systems thinking. General systems theory; system dynamics, emergent properties, structure, feedback and leverage.

Cross-listed with: SYSEN 507

EDSGN 547: Designing for Human Variability

3 Credits

Statistics, optimization, and robust design methodologies to design products and environments that are robust to variability in users.

Cross-listed with: ME 547

EDSGN 548: Interaction Design

3 Credits

Strategies in user-centered design, ergonomic product analysis, statistical data analysis, low and high fidelity prototyping, and innovative design techniques. EDSGN 548 Interaction Design (3) Interaction Design provides an integrative perspective on the types of human-centered design techniques that can be used to analyze existing consumer products and develop innovative solutions. In this class, students will learn qualitative (e.g., observations and surveys) and quantitative methods (e.g., emg sensing and eye tracking) to measure user interactions. This knowledge will be used develop design recommendations for future products. The material will be presented through a variety of hands-on activities including a semester long interaction design project which requires students to evaluate an existing product using human-centered design techniques, develop

solutions based on interaction design principles, prototype solutions, and evaluate their designs in a formal user study. Upon completion of this course, students will be able to identify appropriate research methods (quantitative and qualitative) for guiding interaction design decisions, conduct a user study, and develop design recommendations based on interaction design principles.

Prerequisite: EDSGN 547 or I E 479 or IST 501 or equivalent
Cross-listed with: IE 548

EDSGN 549: Design Decision Making

3 Credits

Complexity of design-making; state-of-the-art methods and tools. EDSGN (IE) 549 Design Decision Making (3) Students in this course will internalize the importance of information and decision-making in design; understand the complexities due to uncertain information, multi-person decision making, technology obsolescence, competitive priorities; become familiar with state-of-the-art methods and tools for design decision-making; and, demonstrate the application of this knowledge in the context of a collaborative design project. Learning in this course will be facilitated in an "apply what you have learned" fashion with ample opportunities for students to demonstrate their learning through in-class participation, discussion of solved problems, hands-on design projects. Strategies, methods, and means of the design process will be discussed and practiced to include such things as understanding client needs, generating design concepts, and evaluating design ideas.

Cross-listed with: IE 549

EDSGN 558: Systems Design

3 Credits

Systems engineering, principles, practices, and applications of systems engineering in analysis, design, development, integration, verification and validation of complex systems. EDSGN 558 Systems Design (3) The course is intended for engineering students who aspire to careers in systems design and those who wish to broaden their knowledge so as to address systems problems. The principal objectives of this course are: (1) to bring systems theory, systems thinking, systems engineering, and systems management together into a single framework and to integrate them such that successful system design is possible; and (2) to immerse the student in the principles, practices, and application of systems engineering through selected readings, textbook study, lectures, and homework assignments and as members of a multidisciplinary systems development team on a systems design project. The course is designed to immerse students in the principles, practices and application of systems engineering within the design, development, integration and deployment of complex systems. Students will learn the special functions and responsibilities of systems engineers in comparison to analysts, design specialists, test engineers, project managers and other members of the systems development teams. They will acquire the knowledge, skills and mindset necessary to be successful as part of a major system development project and will acquire the leadership, problem-solving and innovation skills necessary for success. The objective of this course is to immerse traditional engineering students in the principles, practices, and application of systems engineering and design through selected readings, textbook studies, lectures, homework assignments, and a team design project. This course begins with an overview of systems engineering as a discipline, which prepares the student for the course topics/modules that follow. The course addresses the "hows" and "whys" of systems analysis, design, and development. Students will: 1) learn how

to bridge the gap between capturing user needs and the development of systems by honing skills in the technical activities of systems analysis, systems design, and systems development; 2) learn how to translate abstract visions of the stakeholders and users into a language of specifications, architectures, and designs to direct the system hardware and software development activities resulting in a system that satisfies user needs without latent defects, delivered on schedule, within budget, and profitable for the developing entity; 3) acquire an understanding of systems engineering as a problem-solving solution development discipline that requires a comprehensive understanding of how to analyze systems and how systems are organized, structured, defined, and employed by the user; and, 4) apply the knowledge gained from these lessons toward the analysis, design, and development of a system as members of a multi-disciplinary team.

EDSGN 561: Data Mining Driven Design

3 Credits

The study and application of data mining/machine learning (DM/ML) techniques in multidisciplinary design. CSE 561 / EDSGN 561 / IE 561 / IST 561 Data Mining Driven Design (3) This course examines how theoretical data mining/machine learning (DM/ML) algorithms can be employed to solve large-scale, complex design problems. Knowledge Discovery in Databases (KDD) is the umbrella term used to describe the sequential steps involved in capturing and discovering hidden, previously unknown knowledge in large databases. The course begins with foundational information regarding engineering design and provides an overview of KDD and the emergence of the digital age. Students will investigate data acquisition and storage techniques where they will learn the difference between stated and revealed data as related to design. Students will construct their own databases and learn essential techniques in data base queries (SQL) and management. Data transformation techniques, such as binning and dimensionality reduction, will be examined in the data transformation section of the course. This course has a design-driven focus, which will enable students to solve real-life design challenges spanning diverse domains. Students will work on project-based exercises aimed at proposing novel data mining algorithms, or employing existing algorithms to solve design problems in fields relating to engineering, healthcare, financial markets, military systems, to name a few. Data visualization techniques will also be studied to help communicate complex data mining models in a timely and efficient manner.

Cross-listed with: CSE 561, IE 561, IST 561

EDSGN 562: Design for Additive Manufacturing

4 Credits

Additive manufacturing (AM, colloquially 3D printing) is rapidly changing the face of modern manufacturing. This layer-by-layer manufacturing approach allows for parts to be created with significant levels of complexity and in cost-effective small batches, with reduced raw material waste when compared with traditional manufacturing processes. This technology has given rise to the need for Design for Additive Manufacturing (DfAM) techniques capable of accounting for both the possibilities and restrictions offered by AM in product design. However, due to the relative youth of the technology, understanding of how to properly establish and evaluate these design considerations is still evolving. In this course, students will be exposed to research in the field of DfAM that aims to establish an understanding of both opportunistic possibilities (e.g., lattice structures, topology optimization, and mass customization) and quantify restrictive limitations (e.g., minimum feature

size and support material removal) when designing products for creation with additive manufacturing. The material will be presented through a combination of literature investigations and design exercises viewed through the lens of research in the DfAM field. The objectives of the course include describing the role that DfAM plays in the greater field of additive manufacturing, identifying similarities and differences between existing DfAM approaches and frameworks, synthesizing opportunistic DfAM approaches and how they improve product quality and novelty, identifying and quantifying restrictive DfAM considerations through experimentation, and identifying and discussing key areas of future research to advance the field of DfAM.

CONCURRENT: IE 527

Cross-listed with: AMD 562

EDSGN 571: Compliant Mechanism Design

3 Credits

Compliant mechanisms are devices that exploit mechanical compliance to obtain motion. These devices are frequently seen in organisms and natural systems. In this course, students will gain compliant mechanism design skills transferable to virtually all mechanical design applications. Students will develop the ability to assess design challenges and their compatibility with compliant mechanisms and will improve their mechanical design intuition by understanding the relationships between flexibility, strength, displacement, and force. Students draw on these principles as they study current research literature, theoretical frameworks, and methodologies, predominantly the pseudo-rigid-body model, to synthesize new knowledge in the field of compliant mechanisms. Students grow their abilities to expand the frontiers of compliant mechanism research as they create new design methods. Students will gain experience in the emerging field of origami-based design. Students' capacity to produce creative scholarly products will be reinforced in compliant mechanism design projects, where students will conceptualize, model, prototype, test, and convey compliant mechanism theories and designs.

EDSGN 581: Engineering Design Studio I

3 Credits

Cross-disciplinary teams learn in a studio environment to consider broad aspects and context of engineering design activities. EDSGN 581 Engineering Design Studio I (3) Students examine engineering design from a broad perspective, including design thinking, systems design, and societal contexts. Students bring together many disparate aspects of their previous engineering and non-engineering experiences and investigate new aspects. The material will be presented through a variety of hands-on activities including design projects. Current and best industry practices will also be examined. This course provides a unique opportunity to explore material from many engineering fields and other disciplines within the context of design. This course is a precursor to Engineering Design Studio II (i.e., EDSGN 582). The course will be taught using a studio model.

EDSGN 582: Engineering Design Studio II

3 Credits

Cross-disciplinary teams in an engineering design studio environment with project emphasis on technical and analytical depth. EDSGN 582 Engineering Design Studio II (3) The course is a continuation of Engineering Design Studio I (i.e., EDSGN 581) and will be conducted using

a studio model. The course requires students to bring together the many disparate aspects of their previous engineering and non-engineering experiences. The course material will be presented through a variety of hands-on activities including design projects. Current and best industry practices will also be studied. Students will integrate the depth and breadth of their engineering and personal experiences and focus on analysis and performance prediction throughout the life cycle of the design.

Prerequisite: EDSGN581

EDSGN 585: Engineering Design Portfolio

1 Credits

Preparation of a portfolio summarizing the student's experience with engineering design research and practice. EDSGN 585 Engineering Design Portfolio (1) Industries seeking to fill positions in engineering design frequently ask for a portfolio representing the applicant's work. In this course, students will work with a faculty mentor (i.e., course instructor) to create a design portfolio that reflects the depth of their research and design experience. The portfolio consists of two parts: a detailed white paper or report and a short graphical summary. The graphical summary represents the breadth of the student's experience. Students will reflect on their experiences, identify critical milestones, opportunities for growth, and successes and present these experiences as vignettes in their portfolio. Those examining this element of the portfolio will gain insight into the growth and talent of the engineering designer it represents. The portfolio is mutually beneficial - for the students and the prospective employer.

Prerequisite: EDSGN582

EDSGN 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

EDSGN 594: Research Topics

1-12 Credits/Maximum of 12

Supervised student activities on research projects identified on an individual or small-group basis.

EDSGN 595: Internship

1-9 Credits/Maximum of 9

Supervised off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

EDSGN 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

EDSGN 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

EDSGN 599: Foreign Studies

1-2 Credits/Maximum of 4

Courses offered in foreign countries by individual or group instruction.

International Cultures (IL)

EDSGN 600: Thesis Research

1-15 Credits/Maximum of 999

No description

EDSGN 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

EDSGN 890: Colloquium

1-3 Credits/Maximum of 3

Continuing, professionally oriented seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

EDSGN 896: Individual Studies

1-9 Credits/Maximum of 9

Creative projects with a professional orientation, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

EDSGN 897: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject with a professional orientation that may be offered infrequently.

Engineering Management (ENGMT)

ENGMT 501: Engineering Management Science

3 Credits

Mathematical models involving optimization, simulation and forecasting to provide quantitative solutions to engineering management problems; scheduling, distribution, inventory control.

ENGMT 510: Economics and Financial Studies for Engineers

3 Credits

Economic feasibility of projects, systems and products. Project budgets, estimation, return on investment, supply and demand, and earned value management.

ENGMT 511: Engineering for Energy and the Environment

3 Credits

Engineering analysis of new technologies with environmental consideration leading to alternative energy sources and sustainable development.

ENGMT 520: Systems Optimization

3 Credits

Theory/practice of linear programming will be developed including determination of optimum mix of products, levels of staffing, blending, network analysis, multi-period planning.

ENGMT 530: Engineering Law

3 Credits

Overview of the legal system and legal issues applied to engineering: contracts, bidding, proposals, torts, professional liability, the intellectual property.

ENGMT 539: Engineering Management Strategy

3 Credits

Project- and discussion-based capstone to the engineering management program.

Prerequisite: 27 credits in the engineering management program

ENGMT 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

ENGMT 841: Application of Statistics in Quality and Continuous Improvement in Engineering

3 Credits/Maximum of 999

Application of quality tools to improve products and processes including lean processes and six sigma principles. ENGMT 841 is about learning to apply sophisticated statistical tools for the continuous improvement of products and processes in the manufacturing and service industries. Students will learn how to identify defects (nonconformation to specifications) and provide appropriate solutions that will not only eliminate defects, but also improve the performance. They will be able to take samples from the population, apply appropriate statistical tools and relate the sample characteristics to the population. Students will also apply various control charts to identify the variations in the process and be able to separate the common and special cause variations. Students will be expected to apply the various phases of LEAN and Six Sigma methodologies to a project that will identify various nonvalue added activities and improve the product or process performance.

ENGMT 897: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

Engineering Mechanics (EMCH)

EMCH 500: Solid Mechanics

3 Credits

Introduction to continuum mechanics, variational methods, and finite element formulations; application to bars, beams, cylinders, disks, and plates. E MCH (M E 560) 500 Solid Mechanics (3) This course introduces students to the fundamental principles and basic methods used in solid mechanics. Using indicial notation and integral formulations provides a foundation for more advanced study in continuum mechanics (E MCH 540) and finite element analysis (E MCH 560) specifically and in mechanics in general. The materials behavior is restricted to linear elastic and the emphasis is on stress analysis. Students are expected to have an understanding of elementary mechanics of materials (such as E MCH 013). The course objectives are to: 1) provide students with a firm foundation in solid mechanics. 2) introduce continuum mechanics concepts, variational methods, and the formulation used in finite element analysis. 3) enable students to formulate and solve the boundary value problems commonly encountered in the analysis of structures. The study of solid mechanics starts with the definition of stress and strain and how the two are related by material law. Field equations that relate strain to displacement, ensure a single valued displacement field, and the balance momentum are formulated. These are partial differential equations that can only be solved subject to known boundary and initial conditions. The field equations and boundary conditions comprise a boundary value problem that is usually difficult to solve exactly. Variational methods are used to bound or approximate the solution. The finite element method employs variational methods to formulate generic elements and is a computational tool for solving boundary value problems for complex geometries.

Cross-listed with: ME 560

EMCH 505: Wearable Electronics

3 Credits

Recent advances in wearable electronics have led to the development of powerful biomedical devices that monitor vital physiological signals and provide means of treatment. Conventional electronics today are formed on the planar surfaces of brittle wafer substrates and are not compatible with the textured skin or tissue surfaces. Therefore, stretchable and resorbable electronics are the two missing links in the design process of implantable monitors and in-vivo therapeutics. Novel design strategies present unique opportunities to address the challenges in such a potential medical device that (a) integrates with human physiology, and (b) dissolves completely after its effective operation. In this course, we will apply novel strategies to address challenging issues in these emerging electronics, with examples ranging from sensors for thermal, mechanical, electrical, and electrochemical monitoring to integrated systems that can serve as human-machine interfaces and biomedical devices. This course covers a broad range of topics related to the novel strategies for the emerging electronics, including design and analysis of stretchable and dissolvable electronics, manufacturing techniques for biomedical devices, characterization techniques of soft sensors and actuators, applications, and opportunities for these emerging electronics, among others.

Cross-listed with: ESC 505

EMCH 507: Theory of Elasticity and Applications

3 Credits

Equations of equilibrium and compatibility; stresses and strains in beams, curved members, rotating discs, thick cylinders, torsion and structural members.

Prerequisite: E MCH213

EMCH 514: Engineering Science and Mechanics Seminar

1 Credits/Maximum of 99

Current literature and special problems in engineering mechanics.

Cross-listed with: ESC 514

EMCH 516: Mathematical Theory of Elasticity

3 Credits

Fundamental equations and problems of elasticity theory; uniqueness theorems and variational principles; methods of stress functions and displacement potential; applications.

Prerequisite: E MCH540

EMCH 520: Advanced Dynamics

3 Credits

Dynamics of a particle and of rigid bodies; Newtonian equations in moving coordinate systems; Lagrange's and Hamilton's equations of motion; special problems in vibrations and dynamics.

Prerequisite: E MCH212 , MATH 250

EMCH 521: Stress Waves in Solids

3 Credits

Recent advances in Ultrasonic Nondestructive Evaluation: waves; reflection and refraction; horizontal shear; multi-layer structures; stress; viscoelastic media; testing principles.

Prerequisite: E MCH524A , E MCH524B

Cross-listed with: ACS 521

EMCH 523: Ultrasonic Nondestructive Evaluation

3 Credits

Methods, techniques, applications of Ultrasonic Nondestructive Evaluation wave propagation; signal processing and pattern recognition applied to UNDE; practical laboratory demonstrations.

EMCH 524A: Mathematical Methods in Engineering

3 Credits

Special functions, boundary value problems, eigenfunctions and eigenvalue problems; applications to engineering systems in mechanics, vibrations, and other fields.

Prerequisite: MATH 250 or MATH 251

EMCH 524B: Mathematical Methods in Engineering

3 Credits

Boundary-value problems in curvilinear coordinates, integral transforms; application to diffusion, vibration, Laplace and Helmholtz equations in engineering systems.

Prerequisite: E MCH524A , E SC 404 , or MATH 411

EMCH 524C: Mathematical Methods in Engineering

3 Credits

Green's functions applied to problems in potentials, vibration, wave propagation and diffusion with special emphasis on asymptotic methods.

Prerequisite: E MCH524B , E SC 406H , or MATH 412

EMCH 527: Structural Dynamics

3 Credits

Dynamic behavior of structural systems; normal modes; input spectra; finite element representation of frameworks, plates, and shells; impedance; elastic- plastic response.

Prerequisite: E MCH470 or E MCH571

EMCH 528: Experimental Methods in Vibrations

3 Credits

Investigation of one or more degrees of freedom, free and forced mechanical vibrations, vibration properties of materials, nondestructive testing.

Prerequisite: E MCH470 or E MCH571

EMCH 530: Mechanical Behavior of Materials

3 Credits

Engineering materials mechanical responses; stress/strain in service context of temperature, time, chemical environment; mechanical testing characterization; design applications.

EMCH 532: Fracture Mechanics

3 Credits

Stress analysis of cracks; stable and unstable crack growth in structures and materials; materials fracture resistance.

Prerequisite: E MCH500

EMCH 533: Scanned Image Microscopy

3 Credits

Imaging principles, quantitative data acquisition techniques, and applications for scanned image microscopy are discussed. E MCH 533 Scanned Image Microscopy (3) Scanned Image Microscopy comprises advanced techniques yielding new information in the form of highly resolved micro- and nano-scale images of surfaces and sub-surfaces of materials. The objectives of the course are (1) to endow students with a basic understanding of the principles behind scanned image microscopy, (2) to impart them skills to operate the high-resolution equipment, and (3) to train them to interpret the images obtained. Thus

the course includes presentation of imaging principles (i.e. basic physics and design of instruments including the sensors), quantitative data acquisition techniques (including error analysis) and applications of scanned image microscopy. The course not only emphasizes scanning acoustic microscopy and ultrasonic atomic force microscopy, but it also includes environmental scanning electron microscopy and scanning laser confocal microscopy. These four microscopy techniques are too advanced to be routine and are intended for advanced characterization on the nano- and micrometer scales.

Prerequisite: E MCH440

EMCH 535: Deformation Mechanisms in Materials

3 Credits

Deformation of crystalline/amorphous solids and relationship to structure; elastic, viscoelastic and plastic response over a range of temperatures and strain rates. EMCH 535 / MATSE 564 Deformation Mechanisms in Materials (3) The course will study the relationship between the deformation mechanisms in materials and their structure. The types of deformation behavior considered in the course are linear elasticity (isotropic or anisotropic), viscoelasticity and plastic deformation. For the elastic behavior, the emphasis will be on the way elastic behavior is controlled by atomic structure and microstructure. The constitutive laws that describe this behavior and the assumptions on which they are based will be introduced. The next phase of the course considers the range of deformation behavior from purely viscous (linear or non-linear) to viscoelastic. Initially, the emphasis will be on the effects of temperature and strain history and the way this behavior is described by mechanical analogs. The effect of structure on creep and stress relaxation will be described. The use of linear viscoelasticity in describing the sintering process will also be included. In ductile crystalline materials, deformation is associated with the movement of dislocations. The types of dislocations, their stress fields and energies will be described. These aspects will then be combined with structural features by including considerations of slip geometry and obstacles to dislocation motion. This approach will allow strengthening methods to be identified and quantified. Finally, creep mechanisms in crystalline materials at high temperature will be discussed and quantified.

Prerequisite: E SC 414M or MATSE436

Cross-listed with: MATSE 564

EMCH 536: Thermal Stress Analysis

3 Credits

Thermoelasticity, thermal shock, and design.

Prerequisite: E MCH400 or E MCH500

EMCH 540: Introduction to Continuum Mechanics

3 Credits

Algebra and analysis of tensors; balance equations of classical physics; the linear theories of continuum mechanics.

EMCH 541: Structural Health Monitoring

3 Credits

Technology development to address maintenance and safety concerns related to the aging aerospace/mechanical/civil infrastructure. E MCH 541 Structural Health Monitoring (3) Structural Health Monitoring

(SHM) is the monitoring of the condition of a structure or system using autonomous sensory systems and any intervention to preserve structural integrity. It is nondestructive evaluation with a sensory system that stays in place and enables condition-based maintenance. SHM is a broad multidisciplinary field both in terms of the diverse science and technology involved as well as in its varied applications. However, at its essence are three fundamental elements: sensing, data analysis, and decision making. The technological developments necessary to enable practical structural health monitoring are originating from scientists and engineers in many fields including physics, chemistry, materials science, biology, and mechanical, aerospace, civil, and electrical engineering. SHM is being implemented on diverse systems and structures such as aircraft, spacecraft, ships, helicopters, automobiles, bridges, buildings, civil infrastructure, power generating plants, pipelines, electronic systems, manufacturing and processing facilities, biological systems, and employed for the protection of the environment and for defense. The objectives of SHM are to: improve public safety, reduce maintenance costs, improve readiness, and foster a paradigm shift in design.

EMCH 542: Physical Principles in Biomedical Ultrasonics

3 Credits

Physical principles of advanced ultrasonic imaging and quantitative data acquisition techniques in fields of biology and medicine. E MCH (ACS) 542 Physical Principles in Biomedical Ultrasonics (3) This course focuses on the phenomenon of ultrasound in the context of medical and biological applications, systematically discussing physical principles and concepts. Concepts of wave acoustics are examined and practical implications are explored - first, the generation and nature of acoustic fields and then their formal descriptions and measurement. Real tissues attenuate and scatter ultrasound in ways that have interesting relationships to their physical chemistry, and the course includes coverage of these topics. This course also includes critical accounts and discussions of the wide variety of diagnostic and investigative applications of ultrasound that are available in medicine and biology. The course encompasses the biophysics of ultrasound and its practical applications to therapeutic and surgical objectives. The course utilizes finite element methods for simulation.

Cross-listed with: ACS 542

EMCH 544: Multiscale Modeling of Materials

3 Credits

This course discusses the key issues of the conventional simulation methods at single length and time scales. The course starts with a revisit of mechanics of materials, statistical mechanics, and thermodynamics and kinetics of materials, which form the fundamental basis for the development of physical-based simulation models. Conventional simulation methods at single length scale will then follow, including the quantum mechanical simulations, molecular dynamics, finite element simulations, and phase field modeling. Emphasis will be placed on the coupling strategies bridging different length and time scales. The multiscale methods will be delivered in combination with interesting materials phenomena spanning nanostructured and biological materials.

Prerequisite: EMCH 461

EMCH 550: Variational and Energy Methods in Engineering

3 Credits

Application of variational calculus and Hamilton's principle to various conservative and nonconservative systems; closed form and approximate technique.

EMCH 560: Finite Element Analysis

3 Credits

General theory; application to statics and dynamics of solids, structures, fluids, and heat flow; use of existing computer codes.

Prerequisite: E MCH213

EMCH 571: Foundations of Structural Dynamics and Vibration

3 Credits

Modeling approaches and analysis methods of structural dynamics and vibration.

Prerequisite: AERSP304 , E MCH470 , M E 450 , or M E 570
Cross-listed with: AERSP 571, ME 571

EMCH 581: Micromechanics of Composites

3 Credits

A rigorous application of mechanics to the understanding of relationships between microstructure and thermomechanical properties of composites.

Prerequisite: CERSC414 or CERSC502 or E MCH471 or E MCH507

EMCH 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

EMCH 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

EMCH 597A: **SPECIAL TOPICS**

3 Credits

EMCH 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

EMCH 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

EMCH 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

No description.

Cross-listed with: ESC 602

EMCH 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

EMCH 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

Engineering Science (ESC)

ESC 501: Solar Cell Devices

3 Credits

Principles of photovoltaic energy conversion and their utilization in engineering devices. Emphasis on current solar cell research and development efforts. ESC 501 Solar Cell Devices (3) Photovoltaic energy conversion using organic and inorganic absorbers and liquid and solid materials is examined in depth. The emphasis is on photovoltaic energy conversion using sun light and covers solar cell device physics, materials, and design as well as all four types of photovoltaic structures; i.e., homojunctions, heterojunctions, surface barrier cells, and dye sensitized cells. Basic topics covered in the course include: solar spectra and industry standards; material properties and physics key to photovoltaic structures; and the role of scale in photovoltaics including the use of nano-structures. Computer modeling topics include an introduction to the AMPS code for transport analysis and an introduction to Maxwell's equations solvers for light trapping analysis. The use of such codes in the design of solar cells for light, carrier collection, and efficiency optimization is explored. Solar cell industry developments and research advancements are discussed throughout the course.

Prerequisite: E E 442 or PHYS 412

Cross-Listed

ESC 502: Semiconductor Heterojunctions and Applications

3 Credits

Theory, fabrication techniques, and electronic applications of semiconductor heterojunctions, including metal-semiconductor and electrolyte-semiconductor junctions.

Prerequisite: E SC 314 or E SC 414M

ESC 503: Low Dimensional Nanoelectronics

3 Credits

This course will cover advanced concepts which are essential to understand modern state-of-the art electronic devices based on novel nanomaterials. The course is designed for experimentalists, material scientists, and device physicists who are interested to learn how carrier transport takes place in low dimensional semiconductors such as zero dimensional quantum dots, one dimensional nanotubes (CNT),

quasi-one dimensional nanowires, and two dimensional nanosheets (graphene, MoS₂). The course will begin with a review of semiconductor physics which includes Fermi-Dirac statistics, dispersion relationship (E-k), density of states, electron density, various definition of carrier velocities, and discussion on traditional drift-diffusion (DD) model for carrier transport. We will then adopt a bottom-up approach to understand current flow through a device with only one energy level, which will eventually lead to the formalism of Landauer-Datta (LD) transport model for ballistic conductors. The concept of quantum conductance and transport modes will be taught. We will also learn how to incorporate different scattering mechanisms into the LD model. The LD model will be used to understand current flow through a carbon nanotube (CNT), graphene, and MoS₂. Next, the LD model will be extended to describe heat flow in nanomaterials which forms the basis of various thermoelectric phenomena such as the Seebeck effect, Peltier cooling, etc. The second part of the course will focus on the electrostatics and transport in ballistic and quasi-ballistic metal-oxide-semiconductor field effect transistors (MOSFETs). We will learn how to solve Poisson's equation self-consistently with LD model for Si MOSFET and extend it to ultra-thin-body-silicon-on-insulator (UTMSOI) FETs, FinFETs, CNTFETs, graphene and MoS₂ FETs. The advantage of ultra-thin body channel material for MOSFET scaling and how nanomaterials help in overcoming short channel effects will also be taught. Concepts such as quantum capacitance limit will be introduced. Contact resistance and related issues will also be extensively taught. Various beyond Boltzmann novel device concepts tunnel FETs, phase change FETs, negative capacitance FETs, excitonic FETs, strain FETs for low power computing will be introduced. In the third part of the course we will learn multiple quantum mechanical effects related to transport in nanomaterials such as Quantum Hall effect, energy level broadening, and Coulomb Blockade phenomena in quantum dots. We will also learn multi-electron picture through Folk's Space in order to understand many body interactions. Finally, we will study the matrix version of Schrodinger equation to derive band-structure of different nanomaterials using nearest neighbor semi-empirical approach in orthogonal basis. Generalized transport equations will be obtained using Non Equilibrium Green's Function (NEGF) formalism. Students will be asked to do literature reviews on multiple topics taught in the course. They will also use their learning and solid foundation developed through out the course to execute group projects that are either exploratory in nature or relevant to the state-of-the-art technological problems of the semiconductor industry. This will prepare them for independent and innovative research.

ESC 505: Wearable Electronics

3 Credits

Recent advances in wearable electronics have led to the development of powerful biomedical devices that monitor vital physiological signals and provide means of treatment. Conventional electronics today are formed on the planar surfaces of brittle wafer substrates and are not compatible with the textured skin or tissue surfaces. Therefore, stretchable and resorbable electronics are the two missing links in the design process of implantable monitors and in-vivo therapeutics. Novel design strategies present unique opportunities to address the challenges in such a potential medical device that (a) integrates with human physiology, and (b) dissolves completely after its effective operation. In this course, we will apply novel strategies to address challenging issues in these emerging electronics, with examples ranging from sensors for thermal, mechanical, electrical, and electrochemical monitoring to integrated systems that can serve as human-machine interfaces and biomedical devices. This course covers a broad range of topics related to the novel strategies for the emerging electronics, including design and analysis

of stretchable and dissolvable electronics, manufacturing techniques for biomedical devices, characterization techniques of soft sensors and actuators, applications, and opportunities for these emerging electronics, among others.

Cross-listed with: EMCH 505

ESC 507: Bioarchitecture

3 Credits

Fundamentals of biological architecture observed in nature with emphasis on symmetry and topology with examples from recent literature. Bioarchitecture is the use and implementation of concepts and principles from nature to design functional materials, devices, and systems. Inspired by the structure and utility of biological surfaces, various surfaces have been engineered with micro- and nanoscale features. Bio-derived materials hold great promise to provide a broad range of industrial solutions. These materials can be shaped into various geometries such as fibers, colloids, and thin films. Recombinant expression or direct extraction of bio-derived materials from biological organisms can provide a new generation of recyclable-engineered materials. Understanding the structures and functional characteristics of biological architecture will expedite the design, fabrication, and synthesis of eco-friendly, recyclable, advanced materials, with novel physical properties.

ESC 514: Engineering Science and Mechanics Seminar

1 Credits/Maximum of 99

Current literature and special problems in engineering mechanics.

Cross-listed with: EMCH 514

ESC 515: Research Practices in Engineering

3 Credits

This course is designed to help incoming graduate students prepare to conduct independent thesis research as part of a research group and become part of the broader research enterprise at Penn State. It introduces students to various elements in the research practices domain categorized as discovery and innovation, cooperation, governance, daily life, resources, and career. The elements of discovery and innovation are to: know the state of the art and knowledge gaps, know how to formulate a research objective, know the past literature, think critically and make connections, know what colleagues in your community do, create intellectual merit, and know what facilities are available. Cooperation entails: sharing information, cooperatively developing documents, developing modular procedures/codes, and being part of a team. Participation in governance involves: reviewing the work of others (publications and proposals) and knowing how to become part of professional societies and the review process for funding agencies. Daily life includes knowing the scientific method in general, how research groups function, documentation of progress, ethical norms, the forms of bias, safety standards, handling data and the associated ethics, protecting privacy, how to work with human subjects, humane treatment of animals, and reporting misconduct. Conducting research requires resources and knowing about funding sources, labor and material costs, and lab usage fees. Research practices are integral to establishing a career through planning, networking, dissemination of results, and incorporation of feedback into plans and documents. This course will introduce students to a range of good research practices in Engineering. Topics covered will include: the organization of a research group; a set

of standard tools for performing research including writing, bibliographic organization, version control, data management and backups; tools and good practices for collaboration; good laboratory practices; responsible conduct of research. A large fraction of the course will focus on how to design and conduct research, including reading papers critically, developing bibliographies, writing papers, designing a research project, and writing a research proposal. Full participation in the course satisfies the university requirements for scholarship and research integrity training.

Recommended Preparation: This course is intended for incoming graduate students to prepare them to become independent researchers.

ESC 518: Bioprinting

3 Credits

This course covers the principles of bioprinting in tissue engineering and regenerative medicine for use in fabrication of biomedical related products such as implants, tissue scaffolds, engineered tissues, organs and biological systems. Topics include Tissue Engineering, 3D Printing, Layered Manufacturing and Rapid Tooling in Medicine, Design for Bioprinting, The Bioink, Extrusion-based Bioprinting, Droplet-based Bioprinting, Laser-based Bioprinting, Bioprinters and their components, Application Areas of Bioprinting and New Frontiers in Tissue Engineering such as Organ Printing.

Cross-listed with: BIOE 518

ESC 520: Engineering at the Nano-scale

3 Credits

Engineering at the nano-scale, its current applications, its future directions, and its impact on society are the subjects of E SC 520. The uniqueness of the nano-scale is addressed by first reviewing the basic aspects of our picture of the physical world (e.g. Newtonian and quantum mechanics, geometrical and physical optics) and then exploring the relative impact of these aspects on physical, chemical, and biological phenomena at the nano-scale. Which phenomena dominate as a function of scale and how this competition affects properties and structures is explored in detail allowing the opportunities of the nano-scale to emerge. Impact of the uniqueness of the nano-scale on engineering and the possibilities offered for engineering applications, ranging from manufacturing processing to better building materials to better drug delivery systems, are discussed throughout the course. These creative possibilities afforded by engineering at the nano-scale are highlighted by a varying array of applications taken from fields including medicine and biotechnology, agriculture and food, environmental mitigation, electronics and spintronics, opto-electronics, photonics, sensing, materials, transportation technology, energy production, energy storage, and informatics.

Prerequisite: E SC 412

ESC 521: Pattern Transfer at the Nano-scale

3 Credits

Engineering at the nano-scale often requires creating and then transferring a pattern when fabricating a desired nano-scale structure. This course explores the basic processes of pattern design and then addresses the techniques used to transfer a nano-scale pattern to a surface or structure. The course looks into pattern transfer techniques that employ particles, photons, and additional chemical and physical

means as the transfer mechanisms. Included in the photon approaches are studies of deep UV and X-ray pattern transfer. Particle transfer mechanisms discussed include ion and neutral particle approaches. Physical-contact pattern transfer is also explored including discussions of nano-imprinting lithography, nano-molding lithography, and scanning probe lithography. Chemical pattern transfer is another approach to pattern transfer and one that uniquely uses chemical processes to create patterns. Examples to be discussed in this course include molecular self-assembly lithography and block co-polymer lithography. Emerging pattern transfer techniques, such as magneto-lithography, will be included in E SC 521 for completeness. In many of these pattern transfer methodologies, a "writing" of the transferring pattern into some intermediary medium termed a resist is required. In pattern technologies requiring resists, the resist materials and their positioning as well as required physical and chemical properties will be discussed.

Prerequisite: ESC 520

Cross-listed with: NANO 521

ESC 522: Fabrication and Characterization for Top-down Nano-manufacturing

3 Credits

There are two broad approaches to fabrication and manufacturing at the nano-scale. They are bottom-up and top-down nanofabrication. The two approaches are complementary, with the former having strong ties to biology and the latter having very strong ties to traditional semiconductor processing. E SC 522 focuses on top-down nanofabrication which makes use of two distinct approaches: additive processes and subtractive processes. These are studied in detail in this course by first focusing on the additive processes which deposit or grow materials. The effort then shifts to the subtractive processes which remove materials with a mixture of chemistry and physics, in techniques varying from wet chemical etching to deep ion etching. Achieving nano-scale features with top-down techniques is controllable and verifiable with today's characterization techniques. This control and verification aspect is an integral part of top-down fabrication at the nano-scale. Characterization tools commonly used in top-down nanofabrication are discussed in this course in the context of process development and manufacturing. These tools include optical microscopies, electron and ion beam microscopies, spectroscopies, and scanning probe techniques.

Prerequisite: ESC 521.

Cross-listed with: NANO 522

ESC 523: Fabrication and Characterization for Bottom-up Nano-manufacturing

3 Credits

There are two broad approaches to fabrication and manufacturing at the nano-scale: bottom-up and top-down nanofabrication. These are complementary with the former having strong ties to biology and the latter having strong ties to traditional semiconductor processing. E SC 523 focuses on the bottom-up approaches, which provide an increasingly important alternative to top-down techniques. Bottom-up approaches to nano-scale fabrication mimic nature in harnessing fundamental chemical or physical forces operating at the nano-scale to assemble basic units into larger structures. The bottom-up, or self-assembly, techniques explored in this course cover material synthesis, structure fabrication, and material and structure characterization. The production of 0-D, 1-D, 2-D, and 3-D materials will be discussed and then the assembly of these materials into structures will be explored. Fabrication topics to be

covered will include block co-polymer manipulation, vapor-liquid-solid growth, the Langmuir-Blodgett technique, surface functionalization, molecular self-assembly, DNA Origami, and bacterial and viral assembly. The characterization techniques to be covered will include those emerging tools capable of ultra-precise resolution such as tip-enhanced Raman scanning microscopy, scanning helium ion microscopy, and magnetic resonance sub-nanometer imaging.

Prerequisite: E SC 412, E SC 520, E SC 521

Cross-listed with: NANO 523

ESC 525: Neural Engineering: Fundamentals of Interfacing with Brain

3 Credits

Biophysical basis of neural function, measurable signals, and neural stimulations.

ESC 527: Brain Computer Interfaces (BCI)

3 Credits

Biophysical basis of non-invasive brain signals (electroencephalograms); real-time signal processing.

ESC 529: Neural Control Engineering

3 Credits

The ability to use formal control theory to observe and control neuronal systems is rapidly becoming more feasible as our models of neural systems become more realistic and as our advances in nonlinear Kalman filtering become more sophisticated. This course will explore the cutting edge of nonlinear state estimation of neuronal systems and the construction of control algorithms based on that state estimation. We will give an overview of several canonical neuroscience models, which represent experimental systems that can be controlled: the Hodgkin-Huxley equations, their reduction with the Fitzhugh-Nagumo equations, the Wilson-Cowan model of cortex, and recent models of Parkinson's disease. We will then apply nonlinear state estimation to measurements from such systems and construct control algorithms that interact with such models.

RECOMMENDED PREPARATIONS: Students without a background including calculus, differential equations, and linear algebra should consult with the instructor.

Cross-listed with: PHYS 529

ESC 531: Neuroethics: Science, Technology, and Society

3 Credits

This course provides a close examination into the field of neuroethics and the responsible application of advances in neuroscience research and neuroengineering. Neuroethics is a relatively young and interdisciplinary field of inquiry that aims to be a platform for different stakeholders, including neuroscientists, clinicians, lawyers, engineers, policy makers and the general public to discuss the future of neuroscience and the different applications of neurotechnologies. Neuroethics is a field that brings normative, descriptive, theoretical and practical considerations at the table. This course will cover topics such as different perspectives on neuroethics, its scope and role in recent brain initiatives, ethical and societal implications of brain imaging for medical and non-medical purposes, ethical and societal implications of the use of pharmacological and neuromodulation interventions on the brain, uses of neuromodifiers for enhancement purposes, issues around personhood and other

emerging topics relevant to neuroethics. Among the ethical issues examined in the course are issues related to mental privacy, safety considerations, responsibility, agency, and social justice.

Recommended Preparation: An understanding of ethics, societal implications of technology, and neuroscience or neurotechnology background. Courses in functional and integrative neuroscience, as well as courses that provide a grounding in bioethics
Cross-listed with: BIOET 531, NEURO 531

ESC 534: Advanced Solidification Processes in Metallic Materials

3 Credits

The emergence of advanced manufacturing processes, such as additive manufacturing, has introduced high levels of uncertainty in well-established process - structure - property- performance relationships. A comprehensive understanding of solidification across spatial and temporal scales is needed in order to identify the underlying phenomena driving these unique structures and properties. In this course, the processes driving solidification and the properties of liquid metals will be covered to provide a framework for understanding more complex solidification processes in multi-component systems. Building on a fundamental understanding of both the thermodynamics and kinetics of solidification processes, the properties of interfaces and nucleation and growth will be studied across a range of material systems, including those exhibiting eutectic and peritectic transformations. With this basic knowledge, the role of complex processing conditions and their impact on multi-component alloy systems will be investigated for conditions prevalent in advanced manufacturing processes and correlated with advanced and emerging characterization tools.

Recommended Preparation: Students in this course should have a basic understanding (undergraduate level) of physical metallurgy principles, including solidification, solid-state phase transformations, heat treatment, and thermomechanical processing.

Cross-listed with: MATSE 534

ESC 536: Wave Propagation and Scattering

4 Credits

Survey of analytical and numerical methods for solving acoustic, electromagnetic and elastic wave propagation and scattering problems.

Prerequisite: E MCH524A or E MCH524B

ESC 537: Multiple Scattering Theories and Dynamic Properties of Composite Materials

3 Credits

Acoustic, dielectric, elastic dynamic properties; periodic, random composites; wave propagation and scattering; attenuation, dispersion; super- viscous absorption; sonar, optical, ultrasonic applications.

ESC 540: Laser Optics Fundamentals

3 Credits

Selected topics in optics and laser physics, and their application in laser-materials processing. E SC 540 Laser Optics Fundamentals (3) Over the past two decades, new technologies such as laser-materials processing have moved from laboratory research to commercial applications. Engineers must now understand and apply many concepts of physics that in the past lay outside the boundaries of engineering. This course is

intended for graduate students and practicing engineers whose exposure to physics has been limited to two or three undergraduate courses. It summarizes theories of geometric optics, physical optics, quantum optics and laser physics relevant to laser-materials processing, and it is designed to bridge the gap between abstract concepts and applications. Upon completion of this course, students will have developed sufficient proficiency in these theories to understand the intricacies of their use and application in laser-materials processing as described in the current technical literature. The student's accomplishment will be evaluated by mid-semester and final examinations. E SC 540 will be offered each fall semester. Classes will meet twice a per week; each class will be 75 minutes long. The enrollment for this course is anticipated to be 15 to 30 students.

ESC 541: Laser-Materials Interactions

3 Credits

Laser beam interactions with metallic, ceramic, polymeric and biological materials; effects of wavelength, power, spatial and temporal distributions of intensity. E SC 541 Laser-Materials Interactions (3) This course covers laser beam interactions with metals, insulators, semiconductors, polymers and biological materials relevant to laser-materials processing, and is designed to bridge the gap between abstract concepts and applications. Interactions such as heat flow, thermal stresses, melting, material removal, property changes and plasma effects are related to laser characteristics such as wavelength, power and the spatial and temporal distribution of intensity. Upon completion of this course the student will have developed sufficient knowledge of laser-materials interactions to understand their application in the current technical literature on laser-materials processing. The student's accomplishments will be evaluated by mid-semester and final examinations. This course will be offered each year in the spring semester. The class will meet once a week; each class period will be 150 minutes long. The enrollment for the course is anticipated to be 15-30.

ESC 542: Laser-Integrated Manufacturing

3 Credits

Integration of lasers into manufacturing processes: laser-assisted surface modifications; laser joining; laser-based material shaping processes. E SC 542 Laser-Integrated Manufacturing (3) E SC 542 is intended for graduate students and practicing engineers who have completed E SC 540 and E SC 541. It utilizes classroom lectures to provide a basis for students to develop an understanding of the integration of laser systems into manufacturing processes. Various lasers applicable to macro-processing, optical systems and manipulation components are discussed in terms of integration for industrial processing of materials, which include laser-assisted surface modification, laser joining and laser-based material removal processes. The unique characteristics and attributes of laser processing are discussed and contrasted with other contemporary manufacturing processes. Students will participate in a group project to develop and design an integrated system for selected laser manufacturing processes. Upon completion of this course, the student will understand the system requirements for laser-based manufacturing processes in terms of processing capabilities, equipment capabilities, safety requirements and economic considerations. This course will be offered each year in the fall semester. Classes will meet once per week; each meeting period will be 150 minutes long.

Prerequisite: E SC 540

ESC 543: Laser Microprocessing

3 Credits

Laser microprocessing of engineered and biological materials for electronic, opto-electronic, MEMS and medical/therapeutic applications. E SC 543 Laser Microprocessing (3) This course is intended for graduate students and practicing engineers who have completed E SC 540 and E SC 541. It covers laser processing to produce features and modify properties in metals, organic polymers, inorganic insulators, superconductors, semiconductors and biological materials on the meso, micro and nano scales. The lectures comprise analysis and discussion of selected technical papers on the use of laser microprocessing in electronic, opto-electronic, MEMS and medical-therapeutic applications. Upon completion of this course, the student will have developed sufficient knowledge of laser microprocessing to understand its applications as described in the current technical literature. This course will be offered each year in the spring semester. Classes will meet once per week; each class period will be 150 minutes long.

Prerequisite: E SC 540**ESC 544: Laser Laboratory**

3 Credits

Laser systems for materials processing, safety, critical processing parameters, diagnostic measurements, automation, sensing and control. E SC 544 Laser Laboratory (3) This course is intended for graduate students and practicing engineers who have completed E SC 540 and E SC 541. It covers laser systems for materials processing such as carbon dioxide, neodymium-YAG and ultraviolet laser systems; safety; identification of critical process parameters; measurement of spatial and temporal distributions of intensity, power, polarization, absorptivity and reflectivity; beam and work piece manipulators; automation' methods of sensing and process control. Students will attend lectures, observe demonstrations and perform hands-on measurements. Upon completion of this course, the student will have developed sufficient proficiency in laser techniques to perform them safely in a laboratory setting and to understand the intricacies of their use as described in the current technical literature on laser-materials processing. The student's accomplishment is evaluated by laboratory reports and a final examination. This course will be offered each summer.

Prerequisite: E SC 540**ESC 545: Engineering and Scientific Principles of Additive Manufacturing**

4 Credits

In additive manufacturing (AM), components are fabricated via sequential joining using a bonding agent, curing, sintering, or fusing. AM fabrication of metals, ceramics, polymers, and organics has been demonstrated and is actively being used in industry and academia. ESC 545 / AMD 545 explores these processes with a focus on the fundamentals of sintering and fusion of metals, ceramics, and polymers. The topic is multi-disciplinary, requiring examination of individual AM system components, the physics of energy-material interactions, and the materials science at play during heat-reheat cycles. Opportunities for process sensing and real-time control are explored, as well as the role of post-process technologies in realizing serviceable components. These topics will lead to a discussion of methods and strategies to optimize component properties and characteristics. Current and potential impacts of AM on society are also covered.

Recommended preparations: A course in engineering materials and/or engineering analysis is highly desired but not required.

Cross-listed with: AMD 545

ESC 546: Advanced Metallic Material Feedstocks for Additive Manufacturing

4 Credits

Additive manufacturing (AM) processes use a variety of metallic material forms to produce complex components. These material forms can vary from metallic powders with a rather wide range of size distributions to metal wire to sheet and other more complex composite material types. Knowledge of the processing of these different feedstock forms along with means to characterize them is needed to develop AM processes and procedures capable of being more widely used, particularly in critical applications. In this course, the production, handling, blending, and characterization of common metallic and composite feedstock materials will be covered. Feedstock forms to be addressed include metal and metal-ceramic composite powders, wire, and sheets, along with new product forms becoming available. A multi-disciplinary approach will be taken to elucidate the connections between production, characterization, and handling to develop an understanding of the role of feedstocks on the resulting process-structure-property relationships for AM processes and products.

Prerequisite: ESC 545 CONCURRENTS: MATSE 567, IE 527**ESC 550: Power Semiconductor Devices**

3 Credits

Power electronic devices: Physics of operation, materials, architectural design, processing, reliability of operations, reliability with applications and challenges. E SC 550 Power Semiconductor Devices (3) The design and operation, of the emerging transformative power semiconductor devices, is founded on basic quantum mechanics and solid state physics principles. Power Semiconductor Devices, PSDs, handle high currents, high voltages and operate at high temperatures. Consequently, PSDs are complex in design, and challenging in long-term reliability. We study the fundamentals of PSDs architecture, processing, reliability, materials and characterization. We study Schottky- and P-i-N- rectifiers, the low power range MOSFETs transistors, the middle power range IGBT transistors, and high power range Thyristors. It is estimated that more than 50% of world electricity passes through power semiconductor devices; hence, optimizing the performance and reliability of these emerging power devices coupled with advancing power materials processing may lead to significant future energy savings. The subject matter is appropriate to students of physical sciences, electrical and materials engineering; in addition to broadening their knowledge base, it exposes them to this frontier research area and a new career-path option.

ESC 551: High Power Energy Storage

3 Credits

High-power energy storage technologies including advanced batteries, ultracapacitors, and flywheels. E SC (M E) 551 High Power Energy Storage (3) The course focuses on high-power, in-vehicle energy storage technologies used in hybrid electric vehicles, including advanced batteries, fuel cells, ultracapacitors, and flywheels. An interdisciplinary approach with mechanical, materials, electrical, and chemistry-based concepts provides the foundation to understand the operation and application of these energy storage devices. The course provides a

synopsis of hybrid electric and fuel cell vehicle design, control, and simulation to determine the effect of energy storage components on performance and fuel efficiency.

Cross-listed with: ME 551

ESC 555: Neuroscience Data Analysis

3 Credits

Modern methods for the analysis of neural data. E SC 555 Neuroscience Data Analysis (3) Modern neuroscience experimental methods can generate enormous amounts of complicated data, and a wealth of techniques has sprung up drawing from a wide variety of fields to analyze it. In this course, students will learn how to utilize a toolbox of mathematical and computational techniques to analyze electrophysiological, optical and anatomical data. This course will cover the biophysical origin and measurement of brain signals, as well as the theoretical background of modern analysis methods and their practical implementation. Topics covered include spectral methods, neural encoding and decoding, information theory and image analysis.

Prerequisite: Prerequisite or concurrent: BIOL 469 or equivalent

ESC 562: Solid State Phase Transformations in Metallic Materials

3 Credits

Metallic material systems or alloys are used across a wide range of applications. In order to obtain the desired properties, these materials are subjected to a range of thermo-mechanical processing steps and post-processing heat treatments which drive phase transformations while the material is in the solid state. The mechanisms of these solid-state phase transformations involve a wide range of fundamental materials science concepts, including crystallography, nucleation, grain growth, and diffusion. Practitioners must have knowledge across a range of materials disciplines, including thermodynamics, kinetics, and crystallography, in order to synthesize and capture the complex processes occurring over a wide range of spatial and temporal scales. Knowledge of these fundamental concepts along with their interactions over a range of length scales is applicable across a range of conventional and emerging materials processing fields, from primary steelmaking through heat treatment of nickel and aluminum-base alloys through the additive manufacturing of a wide range of advanced materials. In this course, a comprehensive study of solid state phase transformations in metallic materials will be undertaken. Beginning with the underlying crystal structures prominent in common alloy systems, the role of diffusion and nucleation and grain growth will be undertaken to describe the early stages of phase transformations. The resulting interfaces between different phases will be investigated along with the orientation relationships and the development of equilibrium precipitate morphologies. Building on solid state nucleation theory, microstructural development and precipitation and growth of secondary phases in both equilibrium and non-equilibrium conditions will be studied, to include common invariant transformations as well as spinodal decomposition, order-disorder transformations, and the formation of bainite and martensite. These fundamental materials processes will then be investigated for conditions prevalent in advanced manufacturing processes and correlated with advanced and emerging characterization tools.

Recommend Preparation: A basic understanding of solidification, solid-state phase transformations, heat treatment, and thermomechanical

processing, such as MATSE 259, EMCH 211, and EMCH 213. MATSE 410, 425, 427, or equivalent is preferred but not required. Cross-listed with: MATSC 562

ESC 577: Engineered Thin Films

3 Credits

Broad overview of the preparation-characterization-property relations for thin films used in a wide range of industrial applications.

Prerequisite: MATH 251 , PHYS 237

ESC 581: Microelectromechanical Systems/Smart Structures

3 Credits

Methods of micromachining, smart structure fabrication. Design, modeling for physical, chemical, biomedical microsensors/actuators. Smart structures and microsystems packaging/integration.

Prerequisite: E SC 414M

ESC 582: Micro- and Nano-Structured Light Emitting Devices

3 Credits

Principles and applications of Micro- and Nano-Structured Light Emitting Devices.

ESC 583: Micro- and Nano-Optoelectronic Devices and Applications

3 Credits

Principles and applications of micro- and nano-optoelectronic devices.

ESC 584: Bioarchitecture

3 Credits

Fundamentals of biological architecture observed in nature with emphasis on symmetry and topology with examples from recent literature. Bioarchitecture is the use and implementation of concepts and principles from nature to design functional materials, devices, and systems. Inspired by the structure and utility of biological surfaces, various surfaces have been engineered with micro- and nanoscale features. Bio-derived materials hold great promise to provide a broad range of industrial solutions. These materials can be shaped into various geometries such as fibers, colloids, and thin films. Recombinant expression or direct extraction of bio-derived materials from biological organisms can provide a new generation of recyclable-engineered materials. Understanding the structures and functional characteristics of biological architecture will expedite the design, fabrication, and synthesis of eco-friendly, recyclable, advanced materials, with novel physical properties.

ESC 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

ESC 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

ESC 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

ESC 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

ESC 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

No description.

Cross-listed with: EMCH 602

ESC 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

ESC 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

English (ENGL)

ENGL 501: Materials and Methods of Research

3 Credits

Materials and techniques of research in English and American literary history; form and content of these. Required of all graduate students with an English major.

ENGL 502: Theory and Teaching of Composition

3 Credits

Study of grammar, logic, rhetoric, and style in their applicability to teaching composition.

ENGL 506: The English Language

3 Credits

A problem-centered approach to literary and oral forms of English, utilizing historical and analytic perspectives.

ENGL 507: English Composition Studies

3 Credits

An overview of composition studies, with particular attention to the schools of writing pedagogy.

Prerequisite: EDUC 452 , ENGL 409 , Bachelor's degree, permission of the program

ENGL 510: Post-Colonial Theory

3 Credits

The term post-colonial within itself has manifold meanings and implications. It is also considered a controversial term as many wonder exactly what is post to colonialism. In this class, we will explore colonial discourse theory, the roots of European imperialism and racism, and feminist constructions in relation to post-colonial theory. We will engage with and read critical theory, literature, and film to analyze the relations of power that (re)generate the roles of domination and dominated, and the in-between states of negotiation.

Cross-listed with: AFR 510

ENGL 511: Thesis Workshop and Professional Writing

3 Credits

Professional writing for graduate students. ENGL 511 Thesis Workshop and Professional Writing (3)This course helps graduate students in all fields develop a clear, professional, prose style. Every week they give the instructor five or so pages of their writing and get detailed feedback. Several times during the semester, their week's assignment is read and commented on by the whole class in workshop. By learning how to suggest improvements to their classmates, members learn how to see and fix their own writing problems as well. In addition to style, classes discuss organization, mechanics, formats, and any special problems pertaining to the students' projects and to writing in their specialties. Students must have approximately 30 pages of professional-level writing on hand to revise for this course. Evaluation is based on weekly assignments, on a test, and on a case study.

ENGL 512: The Writing of Fiction

3 Credits/Maximum of 15

Supervised workshop in advanced techniques of writing fiction.

ENGL 513: The Writing of Poetry

3 Credits/Maximum of 15

For the student with considerable experience in writing poetry; a workshop devoted to advanced poetic technique.

ENGL 515: The Writing of Nonfiction

3 Credits/Maximum of 15

Supervised workshop in advanced nonfiction techniques.

ENGL 521: Old English Language

3 Credits

An introduction to the main features of the Old English language; readings in simple Old English prose and poetry.

ENGL 522: Beowulf

3 Credits

Reading and critical analysis.

Prerequisite: ENGL 521

ENGL 530: The Literature of Biography and Autobiography

1-3 Credits/Maximum of 6

Study of biographical and autobiographical theory and practice through analysis of major English and American works in each genre.

ENGL 535: Studies in Jewish American Literature

3 Credits

This course offers students a working analytical familiarity with the history of Jewish writing in the United States (in North American context) and with both the history and the current state of professional study of it. Attention will be paid both to dominant and alternative narratives of this literature. Major historical topics include the earliest, pre-19th century Jewish writers in America; 19th century Jewish American writers; writers of the great Ashkenazi immigration wave of 1881-1924; interwar proletarian and modernist writers; postwar writers of assimilation; the mainstreaming of Jewish American literature in the 1950s and 1960s; post-"breakthrough" Jewish American writers; and 21st-century Jewish American literature and the new immigration. The course analyzes the development of the professional field of Jewish American literary study, including its prehistory and origins in Wissenschaft-based historicism; the professionalization of the field in the Viet Nam era; the growing dominance of so-called New Jewish Cultural Studies of the '80s and '90s; and new theoretical approaches of the first decades of the 21st century. Finally, the course examines the key debates and faultlines in the field today, including the divide between historicist and critical approaches; differences between English Department-based and Jewish Studies-based Jewish American literary study; the situation of Jewish American literary study vis-à-vis Americanist literary study and English Department-based literary study more generally; Cultural Studies-based approaches to the field vs. Literary Studies-based approaches; Comparativist approaches vs. non-Comparativist approaches; the move toward interdisciplinarity; and the ongoing struggle to theorize the field.

Cross-listed with: JST 535

ENGL 540: Studies in Elizabethan Prose and Poetry

1-3 Credits/Maximum of 12

Major figures studied will vary from year to year. Writers studied might include figures such as Spenser and Sidney.

ENGL 541: Medieval Studies

1-3 Credits/Maximum of 12

Studies in medieval English literature. Topics studied might include medieval romances, drama, or major figures aside from Chaucer.

ENGL 542: Middle English Literature

3 Credits

A survey of Middle English literature, exclusive of Chaucer. ENGL 542 Middle English Literature (3) This seminar offers a survey of Middle English literature, exclusive of Chaucer, through a close study of some of its characteristic forms and genres. The course begins with the linguistic features of Middle English, with attention to the major dialects of assigned texts (dialect instruction will continue throughout the semester as appropriate). Readings concentrate on several major forms and genres

(such as romance, debate poetry, religious writing, lyrics) and authors (such as La?amon, the Pearl Poet, Margery Kempe, Lydgate, Malory). The course combines close reading and translation with ranging investigation into literary contexts and traditions. Considering the multilingual culture of medieval England, students may also read analogue and source literature in languages such as French and Latin (all of which will be taught in translation). Discussion of assigned texts will be situated within the relevant scholarship and criticism (current and historical).

ENGL 543: Studies in Early Seventeenth-Century Literature

1-3 Credits/Maximum of 12

Major figures studied will vary from year to year. Writers studied might include Donne, Herbert, Jonson, Bacon.

ENGL 545: Chaucer

1-3 Credits/Maximum of 12

Major and minor works of Geoffrey Chaucer. The works studied will vary from year to year.

ENGL 546: Milton

3 Credits

The poetry and prose of John Milton.

ENGL 548: Elizabethan and Jacobean Drama

1-3 Credits/Maximum of 12

English drama from 1558 to 1642, exclusive of Shakespeare.

ENGL 549: Shakespeare

1-3 Credits/Maximum of 12

Special problems of sources, chronology, text, characterization, and motivation in the drama.

ENGL 550: English Literature 1660-1800

1-3 Credits/Maximum of 12

Major figures studied will vary from year to year. Writers studied might include Dryden, Swift, Pope, Johnson, Fielding, Gibbon.

ENGL 553: Literacy Studies

3 Credits

An overview of current research on literacy, with particular attention to language, thought, and learning and their applications to writing. ENGL 553 Literacy Studies (3) ENGL 553 will present current research on literacy, with an emphasis on language acquisition, learning theory, and their applications for writing pedagogy.1. Instructional, Educational, and Course Objectives:As a result of having completed the course, students will be able to: Demonstrate a clear understanding of current theories of literacy, including the reciprocity of writing and thinking, speaking and reading. Articulate and discuss various approaches to instruction, including uses of writing in the classroom and writing to learn. Compare and contrast traditional and current approaches to teaching writing. Demonstrate and apply the concepts of the curriculum models for teaching writing. Utilize practical methods for identifying goals and applying theory to instructional plans.2. Students' evaluation will be

based on their knowledge and understanding of instructional objectives, demonstrated in written assignments, class discussions, and other assignments.

Prerequisite: EDUC 452 or ENGL 409 ; Bachelor's Degree and permission of program

ENGL 554: Studies in Early American Literature

1-3 Credits/Maximum of 12

Major figures studied will vary from year to year. Writers studied might include Bradstreet, Taylor, Mather, Franklin, Edwards, Paine.

ENGL 555: Visualizing Gender

3 Credits

This course analyzes how gender identities relate to the creation, use, and analysis of visual artifacts and bodily practices. Visual texts condition and are conditioned by intersectional embodiments of gender. In an attempt to understand and critically evaluate the role visual culture plays in our gendered lives as a dominant conduit of knowledge and identity production, this seminar examines visual processes and objects as they are informed and shaped by a nexus of gender, race, sexuality, class, nationality, and other forms of identity. The visualization of gendered forms of identity involves codes that produce bodies as signifiers of chaos, order, beauty, disease, nature, culture, evil, and virtue, including actions bisected according to binaries of masculinity and femininity. The seminar employs analytical approaches to these dynamics, including feminist, queer, and critical race theories of the visual as ways of interrogating a range of visual artifacts and bodily practices. After surveying key foundational texts, the course predominantly engages contemporary works and practices along complex gender matrices, including new directions in visual culture from the 1990s onward.

Cross-listed with: VSTUD 555

ENGL 556: Reading Film

3 Credits/Maximum of 12

A practical and historical approach to film theory and analysis. This seminar develops critical visual literacy by examining a range of practices in cinema study, with emphases on the relation of film to literature and the analysis of film meaning. The course asks how to read a film, and considers the multiple ways that films combine framing, movement, editing, narrative, character, and genre toward the production of culture, ideology, identity, desire, poetic imagery, and community. Students will explore a wide range of critical methods, and will view one to two films per week. Readings will range from novels to classic film theory, cultural studies, belles-lettres, film criticism, radical poetics, apparatus theory, media theory, and contemporary philosophy.

Cross-listed with: COMM 556, VSTUD 556

ENGL 557: Authors and Artists

3 Credits

This course explores formal and historical links between literature and art in modernist movements. "Ut pictura poesis" (like painting [is] poetry). This statement, originally articulated by the ancient Roman poet Horace, has been quoted and debated ever since. Links between art and literature have exerted a formative influence on the development of modern fiction and poetry as authors and artists in various avant-

garde groupings collaborated and competed to generate modes of artistic expression appropriate to modernity. This course examines those interactions. Course objectives are to bring together for comparative examination: - formal or generic relationships between texts and images at particular historical moments. - issues of creative collaboration and cross-pollination between writers and artists, which have been crucially important in the history of literature and poetry. - conceptions of creativity as these have been expressed by writers using the figure of the artist. This course allows students to explore the ways knowledge of literature and skills in critical reading can be rewardingly brought to bear on the visual arts, and to consider how visual art can illuminate the workings of literature both for individual readers and in the classroom.

Cross-listed with: VSTUD 557

ENGL 558: Nineteenth-Century British Fiction

1-3 Credits/Maximum of 12

Major figures studied will vary from year to year. Writers studied might include Dickens, Thackeray, the Brontes, George Eliot, Hardy.

ENGL 560: American Romanticism

1-3 Credits/Maximum of 12

Major figures studied will vary from year to year. Writers studied might include Hawthorne, Melville, Emerson, Thoreau, Whitman.

ENGL 561: Studies in the Romantic Movement

1-3 Credits/Maximum of 12

Major figures studied will vary from year to year. Writers studied might include Blake, Wordsworth, Coleridge, Byron, Shelley, Keats.

ENGL 562: Studies in the Literature of Victorian England

1-3 Credits/Maximum of 12

Figures will vary from year to year. Writers studied might include Tennyson, Browning, Arnold, Newman, Ruskin, Trollope.

ENGL 564: Studies in Nineteenth-Century American Literature

1-3 Credits/Maximum of 12

Writers will vary from year to year. Writers studied might include Cooper, Poe, Dickinson, Twain, James.

ENGL 565: Period Studies in African-American Literature

3 Credits/Maximum of 9

Studies of periods in African-American literature. Periods might include the Harlem Renaissance or the Black Arts Movement.

ENGL 566: Genre Studies in African-American Literature

3 Credits/Maximum of 9

Genre will vary from year to year, but will include categories such as poetry, fiction, essays, sermons, autobiographies, short stories.

ENGL 567: Thematic Studies in African-American Literature

3 Credits/Maximum of 9

Exploration of key concepts in African-American culture as manifested in various literary discourses.

ENGL 568: Gender Issues in African-American Literature

3 Credits/Maximum of 9

Gender issues in African-American literature and culture. Issues may include the Black woman writer or Gay and Lesbian writers.

ENGL 570: The Writer as Critic: Reviewing Contemporary Poetry, Fiction, and Non-Fiction

3 Credits

Students will write and revise book reviews of poetry, fiction, and non-fiction for a variety of newspapers and literary magazines. ENGL 570 The Writer as Critic: Reviewing Contemporary Poetry, Fiction, and Non-Fiction (3) In this class, students will read books and write reviews of those books, following a detailed schedule of readings and assignments established in the syllabus. Success in this class depends upon the student's ability to set priorities, organize materials, followup on initial contacts with presses and editors, and revise all reviews to publishable standards. Students begin by reading published book reviews and two texts (one poetry, one fiction) assigned by the instructor. Analyzing the structure of the published reviews, students draft model 200- and 550-word reviews, using the published reviews as guides. As the course progresses, students contact publishing houses and presses to request review copies, while simultaneously writing to editors with project proposals. With longer reviews--700 and 1,000 words--students engage complex issues about the economics and politics of publishing. Readings from the course Sampler (provided by instructor) inspire students to position themselves as literary citizens in the national conversation about contemporary writing. "The Writer as Critic" supplements the MFA course offerings in non-fiction. Students in all genres may practice advanced expository prose while gaining a practical skill. For students in the MFA program, this course fulfills a literature seminar requirement. Students will be evaluated on the quality of final reviews, the timely completion of all drafts, participation in editing teams, and final portfolio of correspondence. This course, for which MFA students have first priority, will be offered approximately every other year with a maximum of 12 students.

ENGL 571: Writer in the Community

3 Credits

Students study the theory and practice of creative writing pedagogy in non-university settings.

ENGL 573: Studies in Twentieth-Century British Literature

1-3 Credits/Maximum of 12

Major figures studied will vary from year to year. Writers studied might include Yeats, Conrad, Joyce, Shaw, Lawrence, Auden.

ENGL 574: Studies in Twentieth-Century American Literature

1-3 Credits/Maximum of 12

Figures studied will vary from year to year. Writers studied might include Dreiser, Wharton, Eliot, Hemingway, Fitzgerald, Faulkner, O'Neill, Williams.

ENGL 575: Experimentation and Modernism in Twentieth-Century British and American Fiction

1-3 Credits/Maximum of 12

Figures studied will be drawn from the era of Joyce and Virginia Woolf to the present.

ENGL 576: Studies in Twentieth-Century American Fiction

1-3 Credits/Maximum of 12

Concentrated study in such major American writers as Hemingway, Faulkner, and Fitzgerald.

ENGL 577: Contemporary Fiction

1-3 Credits/Maximum of 12

Exploration of contemporary English language fiction.

ENGL 580: Comics and Graphic Novels

3 Credits

A survey of comics and graphic novels, primarily in English. This seminar provides a survey of the comics medium and an introduction to the academic field of Comics Studies. Students acquire facility in the structural and formal analysis of comics and sequential narrative, as well as knowledge of significant critical theories and methodologies within the field of Comics Studies. Assigned primary texts may be targeted to a particular genre, mode, historical period, or creator(s). While the course has a general focus on North America, students may also read texts from European, Japanese, and/or South American traditions (all of which will be taught in translation), not to exceed 25% of the course. Discussion of assigned texts will be situated within relevant scholarship and criticism (current and historical).

Cross-listed with: VSTUD 580

ENGL 582: Survey of Contemporary Literary Theory

3 Credits

Exploration of the dimensions of discourse as reflected in recent theories of rhetoric, poetics, and literary criticism.

ENGL 583: Studies in Critical Theory

1-3 Credits/Maximum of 12

Study of specific contemporary critical approaches to literature and application to English and/or American literary works.

ENGL 584: Studies in Rhetoric

1-3 Credits/Maximum of 12

Specific rhetorical problems, issues, or figures; topics will change from year to year.

ENGL 586: Readings in Literature

1-12 Credits

Programs of readings designed to meet specific needs of individual students.

ENGL 589: Studies in American Poetry

1-3 Credits/Maximum of 12

No description.

ENGL 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

ENGL 596: Individual Studies

1-12 Credits/Maximum of 12

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

ENGL 597: Special Topics

1-9 Credits/Maximum of 18

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

ENGL 597E: ****SPECIAL TOPICS****

3 Credits

ENGL 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

ENGL 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

ENGL 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Supervised experience in teaching and orientation to other selected aspects of the profession at The Pennsylvania State University.

Enterprise Architecture (EA)

EA 594: Research Topics

1-18 Credits/Maximum of 18

Supervised student activities on research projects identified on an individual or small group basis.

EA 871: Enterprise Architecture Foundations I

3 Credits

Theoretical foundations and practice of enterprise architecture.

EA 872: Enterprise Architecture Foundations II

3 Credits

Develops additional capabilities for justifying Enterprise Architecture decision making.

Prerequisite: IST 871

EA 873: Enterprise Modeling

3 Credits

EA 873 is intended to provide an exposure to the foundational concepts and practices of effective enterprise modeling for EA. It explores the general and specific uses and effectiveness of architectural modeling approaches to describe an organization, and examines model-based tools to support, influence, and enable organization planning and decision-making. Emphasis is placed on understanding different modeling approaches, standards, and styles and in the use and interpretation of the models. Students will use enterprise modeling approaches and technology tools to develop descriptive models and understand the use and role of the enterprise architecture repository relative to reusability of models.

Prerequisite: EA 871; BA 809

EA 874: Enterprise Information Technology Architecture

3 Credits

Enterprise Architecture (EA) is the analysis and design of an enterprise in its current and future states from a strategy, business, and technology perspective. It helps to integrate and manage IT resources from a strategic and business-driven viewpoint. This course is intended to provide an exposure to the foundational concepts associated with each of the three primary layers of the enterprise information technology architecture stack: the enterprise applications architecture, the enterprise data architecture, and the enterprise technology infrastructure architecture. The course provides a fundamental understanding of the major components and functions of these layers in order to have a comprehensive understanding of the enterprise. Students will acquire knowledge about the key foundational aspects of these three technical layers of the enterprise architecture, learn what decisions need to be made in each layer, and learn how the layers interrelate. The perspectives covered in the class can be organized roughly by their level of analysis: overview of the enterprise technology stack, the enterprise application architecture, the enterprise data architecture, the enterprise technology infrastructure architecture, the enterprise security architecture, and current issues surrounding the enterprise information technology architecture. Students will compare and contrast the different layers of the enterprise information technology architecture and describe the interrelationships between the different layers of the enterprise information technology architecture.

Prerequisite: EA 871

EA 876: Architecting Enterprise Security and Risk Analysis

3 Credits/Maximum of 999

Analytical skills to produce credible, meaningful answers to critical risk management questions across enterprise architecture layers, including the supply chain. This course develops analytical skills to produce credible and meaningful answers to critical risk management questions across the enterprise architecture layers, including the supply chain. These extended enterprise risks originate from both natural and human-instigated hazards. Topics include critical thinking, enterprise analysis, risk assessment and associated analysis methods, risk communication, and risk control.

Prerequisite: EA 871

EA 878: Enterprise Architecture Leadership

3 Credits

Develops additional capabilities for leading, communicating, and implementing Enterprise Architecture. EA 878 Enterprise Architecture Leadership (3) Enterprise Architecture is recognized as a key catalyst that organizations can use to make progress towards a state of optimal operational efficiency whereby integrated information maximizes interactions between all stakeholders, both internal and external. Poor leadership, decision-making, and management are often cited as top reasons for enterprise architecture failure. This course is intended to synthesize major concepts presented in prior courses under the broad umbrellas of leadership and decision making. One of the major goals of a well-constructed enterprise architecture program is to facilitate the design and implementation of enterprise processes and systems that support the effective and efficient movement and dissemination of timely information across the enterprise. This information is critical to effective decision making and effective leadership. The course will deepen knowledge in the areas of effective EA leadership and management as well as in the areas of enterprise change management, effective communications, negotiation, organization political considerations, and interpersonal skills. An examination of research findings, the sharing of professional experiences, and the exploration of the characteristics of high-performing organizations and the kind of leadership that contributes to their performance will be core to the course. The perspectives covered in the class can be organized roughly by their level of analysis: EA leadership, EA decision making and strategic planning, and EA management and communication. For each general topic area, core readings are used to define standard vocabulary, concepts and relations, methods and criteria for evaluation, and implications for enterprise architecture. This course is designed to tie major concepts together and help the student understand how topics such as strategy, understanding organizations, enterprise modeling, enterprise technologies, etc. are interrelated and support effective decision making and leadership. Students will complete written assignments that focus on solidifying the understanding of the course content and participate in on-line discussions of EA topics with fellow students that will bring out real-world experiences in dealing with EA issues, challenges, and opportunities. Student teams will also participate in the analysis of case studies presented by industry experts, where students explore team dynamics, diagnostics, and management related to effective EA leadership. Students will also complete a semester long capstone team research project that is shaped by outcome discussions with respect to one or more areas covered in the course. The teams will present their final projects to the other members of the class at the end of the course. Key topic lectures will feature industry experts.

Entomology (ENT)

ENT 518: Insect Natural History

2 Credits

Experiential learning in field ecology highlighting insect dynamics, diversity and adaptations in terrestrial and aquatic systems. ENT 518 Insect Natural History (2) This is an experiential learning course in field ecology highlighting insect dynamics, diversity and adaptations in terrestrial and aquatic habitats. On site sessions will introduce ecological processes and natural history from a variety of habitats. Students will gain experience in field sampling and collection techniques, field notebook documentation, GPS use, and specimen databasing. Course is designed for those with limited field experience with insects. The course is intended for new graduate students in Entomology and Ecology. Insect adaptations across multiple habitats are observed in natural, agricultural, and forestry settings and the underlying ecological processes, anthropogenic interactions, and agro/forestry ecosystem management approaches are introduced. A team of faculty and staff from Entomology, and various outside instructors accompany students to various field sites to characterize the attributes, problems, and solutions relative to insect abundance and diversity in each setting. Students learn a wide variety of field sampling and collection methods, sight and key identification to order and major family levels, and standard curation and databasing techniques for arthropods collected for scientific purposes. Methods taught include a variety of light and pheromone trapping, pit traps, sticky traps, malaise traps, sweep netting, and sequential sampling. Curation methods including spreading and pinning, and alcohol and other preservation liquids and drying for immature insects are covered. Community diversity and Shannon Index and advanced statistical characterization of community complexity methods are applied to differing community data that are gathered by teams of students during their chosen mini projects as well as the aquatic community sampling results for Spring Creek vs. Cherry Run. A student collection is required, and at the end of the week each collection is evaluated and graded. Student field notebooks are kept throughout the course and these too are evaluated on the last day and then returned to the students for their continued use. The course is offered over a 5-day period at the end of the insect "active season" with collection and sampling activities requiring natural light or darkness for a variety of the species studied. For example, aquatic insect stream sampling must be done in daylight and collecting for mosquitoes and other insects must be done at dusk or at night with specialized traps. It is essential that this course be completed prior to night temperatures in the 50's and before the first killing frost.

Prerequisite: one of the following courses: ENT 425 , ENT 402W or ENT 410 , BIOL 436 , BIOL 446 , or ECLGY510

ENT 520: Frontiers in Insect Science

4 Credits

This graduate course is designed to provide an overview of the diversity of subjects that fall within the subject of entomology.

ENT 522: Critical Thinking and Professional Development in Entomology

6 Credits

This is a required course for Entomology graduate students focusing on developing the professional skills needed for a successful career in basic or applied research. ENT 522 Critical Thinking and Professional Development in Entomology (6) This required course for Entomology

graduate students focuses on developing the professional skills needed for a successful career in basic or applied research. Major topics addressed include (i) effective scientific communication, (ii) the mechanisms of research funding and peer review, (iii) critical evaluation of scientific evidence and arguments, (iv) basic principles of study design, and (v) research ethics and effective collaboration. Students engage in a variety of classroom activities - including lectures, discussions, and peer review of written assignments - and interact with instructors possessing expertise in each of the particular subject areas addressed, as well as with guest instructors working on cutting-edge topics in insect science and related fields. The course emphasizes practical application of the material presented to students' own research. Over the course of the semester, each student reviews relevant literature and develops and refines a research proposal based on their own scientific interests.

ENT 530: Seminar in Insect Science

1 Credits/Maximum of 4

Seminar in insect science. Topics range from insect phys & immunology to chemical ecology & epidemiology. ENT 530 Seminar in Insect Science (1 per semester/maximum of 4) This class will examine current issues in insect science. Topics for a semester will range from insect physiology, immunology and disease to population ecology, agroecology, and biodiversity. The intent is to generate useful discussions that will help participants advance their own understanding of the broader debate about various research topics in insect science. Specific topics will change each semester allowing students to choose those topics of the greatest interest. Topics will be proposed by faculty with expertise in specific areas. Seminal articles, peer-reviewed literature, government and industry reports, webpages and government regulatory documents will be selected by the faculty member proposing the topic to broaden and deepen student understanding of the topic area. Class participation is expected during discussions and oral presentations of topic areas will be expected.

Prerequisite: Prerequisite or concurrent: ENT 520

ENT 532: Insect Biodiversity and Evolution

4 Credits

This course is designed to teach students about insect taxonomy, evolutionary history, collection and preservation techniques, morphology, fossils, and natural history. Lab work focuses on adult forms, especially of insects found in Pennsylvania. Students learn how to handle specimens, use diagnostic keys, and identify insects by sight. Collecting techniques will be honed during field trips. Upon completion of this course students will be able to: (1) teach others how to collect, preserve, and transport insect specimens; (2) name and sight-identify all insect orders and several common local families; (3) label a generalized insect diagram with external anatomy terms; (4) draw a phylogenetic tree of relationships between insect orders; (5) demonstrate understanding of how to read a phylogenetic tree, what kinds of data are used to estimate trees, how those data are analyzed, and what it means to be monophyletic; (6) describe key innovations and life history strategies of major insect lineages; (7) solve taxonomic problems and describe how species and other taxa are named and described, i.e., understand the fundamentals of taxonomic practice; (8) name and briefly describe the latest developments in insect biodiversity research; (9) explain how hexapods inform us about biodiversity and influence our conservation decisions.

ENT 535: Statistical Techniques in Entomology

3 Credits

Research methods course covering experimental design and analysis in entomology, ecology, and the agricultural science. ENT 535 Statistical Techniques in Entomology (3) This natural sciences study design, analysis and interpretation course is for graduate students in ecological and agricultural sciences. The goal of this course is to provide students with the tools needed to conduct quantitative studies. The course focuses on study design and methodology by covering topics such as the relationship between study design and data types and data collection, and interpretation of results.

ENT 539: Chemical Ecology of Insects

3 Credits

Interactions of insects with environmental chemicals, including natural and synthetic compounds; host finding and other behavior modifying cues.

ENT 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

ENT 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses

ENT 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

ENT 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

ENT 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

ENT 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Supervised experience in development of instructional materials, organizing and conducting lectures, laboratories, and evaluating students in Entomology courses (1-599).

ENT 603: Foreign Academic Experience

1-12 Credits/Maximum of 12

Foreign study and/or research constituting progress toward the degree at a foreign university.

Entrepreneurship (ENTR)

ENTR 500: Innovation and Entrepreneurship

1-3 Credits

Practical and theoretical insights into analyzing a new business opportunity that you have created. ENTR 500 Innovation and Entrepreneurship (1-3) In this course, you will explore the individual, group, organizational, and inter-organizational levels of analysis. You will gain both practical and theoretical insights from the course as well as creativity, innovation, and entrepreneurship by focusing on the initial identification and quantification of an innovative opportunity and presentation to stakeholders.

ENTR 502: Business Modeling and New Venture Creation

2-3 Credits

ENTR 502 focuses on the process of launching a new venture, in a corporate setting or as a new startup, including identifying a problem or market opportunity, developing business models, forming a team, financing, analyzing markets, assessing the competitive environment, and planning to acquire leadership talent. A business model canvas framework is used as the primary tool for describing, analyzing, and designing business models. In essence, this course identifies and defines the key components necessary to develop a formal business plan. Concepts and techniques explore new venture creation business strategies, including different approaches for business model development. Students will gain insight into how to translate new ideas into viable projects and business ventures. Students will learn the importance of understanding markets, customer segments, and the competitive landscape, as well as how to obtain funding for new ventures. Lastly, the issue of how to acquire leadership and human resource talent to make a new venture viable over time is investigated.

ENTR 503: Garber Venture Capital Practicum

1-2 Credits/Maximum of 2

Structure investment opportunities, conduct due diligence, and potentially invest funds from the Smeal College of Business Garber Venture Capital Fund.

ENTR 504: Essentials of Business Planning

2 Credits

Create a concise and coherent business plan for a start-up or a new corporate initiative.

ENTR 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

ENTR 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

ENTR 810: Emerging Trends, Technology, and Corporate Innovation

3 Credits

This course explores emerging trends and disruptors in technology and industry that create new markets and influence decision making, product development, business models, and business practices associated with innovation. This course covers the major areas of concern that affect disruptive innovation and examine the role of disruptive innovation in fostering new business ventures. Specific examples of disruptive innovation will be analyzed. Students will gain insight into how breakthroughs in technology, science, and business modeling play out in establishing new products and markets. Students will be exposed to, and investigate, the best practices of key industries (e.g., healthcare, manufacturing, banking, retail, etc.) and organization functions (e.g., marketing, finance, research and development, sales, etc.) as they relate to fostering and supporting innovation and entrepreneurship in a business enterprise. Students will learn the importance of taking an interdisciplinary approach to thinking about and planning innovation projects and programs, in terms of both internal and external forces.

ENTR 820: Corporate Innovation Strategies and Entrepreneurial Methods

3 Credits

This course is designed to survey and explore the methods used to foster innovation and entrepreneurship in a corporate setting. Emphasis will be placed on the methods used in organizations to foster creativity, innovation, and new venture creation. This course covers both tactical and strategic approaches to innovation and entrepreneurship, and examines these in multiple contexts, including technology, business process, product, and strategy. Furthermore, the course will expand on widely accepted frameworks and perspectives for managing innovation, such as agile product development, and the lean startup approach. Students will also delve into the more abstract notion of how to create and enable an organizational culture of innovation, manage conflict, and negotiate agreements effectively. Lastly, a final objective of the class is to ensure students understand how to protect and manage intellectual property.

ENTR 830: Entrepreneurial Business Planning and Strategy Execution

3 Credits

This course is designed to allow students to integrate, synthesize, and apply what they have learned in prior courses, and gain further insight into two major drivers of business success, innovation and entrepreneurship. As such, this course will serve as a culminating experience in innovation and entrepreneurship learning. The strategic implications of innovation are examined, including an emphasis on how to be critically aware of factors which may inhibit or facilitate innovation in an organization or team. Students will gain insight into how to write a business case to clearly and effectively outline the pros and cons of taking a specific course of action. Business case development will also rely on how to perform cost-benefit analysis. The course will also teach students the key issues, elements, and approaches associated with translating a sound business model into a compelling business plan.

(preferably for a new venture). The key elements of a formal business plan will be explored in-depth, including how to write an executive summary, product description, market assessment, team formation plan, pricing models, sales forecasting, financial planning, and implementation planning. The course will emphasize the context and issues associated with developing a formal business plan, developing and understanding business models, and using the planning process to formulate and execute implementation strategies. Various implementation approaches will be compared and contrasted. The course will also enable students to construct business models and plans that present key points in a direct, clear, and appealing way.

Prerequisite: ENTR 810 and ENTR 502 and ENTR 820

Environmental Engineering (ENVE)

ENVE 540: Biodegradation and Bioremediation

3 Credits

Microbial degradation and transformation of organic and inorganic contaminants. Principles of current bioremediation technologies for soil and groundwater contaminants.

Prerequisite: ENVE 411

ENVE 550: Chemical Fate and Transport

3 Credits

Chemical fate and transport modeling of environmental systems as applied to ecological systems, treatment technologies, and human health exposure assessments. ENVE 550

ENVE 569: Environmental Risk Assessment

3 Credits

Overview of ecological and human risk, including hazard identification, dose response, exposure assessment, and risk characterization.

ENVE 591: Research Methods in Environmental Engineering

1 Credits

Preparing a research proposal, critical reading of literature, understanding ethics in research, experimental design, data analysis and presentation. ENVE 591 Research Methods in Environmental Engineering (1) The goal of this course is to provide information for graduate students regarding the pertinent research methodology that applies to their research projects in environmental engineering and sciences. Understanding research methods is the key to generating valid research results which can be used to guide the design, operation, and evaluation of environmental treatment assessment, treatment, and control operations and facilities. Valid research results also require proper quality control and quality assurance plans and ethical research conduct and practices. This course will provide foundational information regarding how to conduct an effective literature review, set up research hypotheses, prepare research experiments, collect and analyze research data, discuss research results, and summarize research findings. For research result dissemination, this course will teach students how to prepare and submit research manuscripts for publication in scientific journals and technical conference proceedings. Patent application preparation also will be briefly introduced in the course instruction. The course also will provide

two hours of instruction on research/professional ethics, focusing especially on plagiarism and data falsification/fabrication.

Prerequisite: E P C590

ENVE 594: Research Topics

1-18 Credits/Maximum of 18

Supervised student activities on research projects identified on an individual or small-group basis.

ENVE 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

Environmental Pollution Control (EPC)

EPC 590: Colloquium

1 Credits

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

EPC 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

Epidemiology (EPID)

EPID 595: Internship

1-18 Credits/Maximum of 18

Supervised, research-oriented, off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required

EPID 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including non-thesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

EPID 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 0

EPID 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

Finance (FIN)

FIN 506: Portfolio Theory and Policy

3 Credits

Rigorous examination and analysis of asset-holder behavior under conditions of risk and uncertainty.

FIN 531: Financial Management

3 Credits

An intensive examination of techniques available to aid the financial manager in decision making.

Prerequisite: ACCTG511 or ACCTG512 ; B A 533 , SC&IS535

FIN 532: Financial Decision Processes

3 Credits

Financial decision making under uncertainty; positive and normative models and current issues in financial management.

FIN 550: Financial Analysis and Valuation

2 Credits

Builds upon and reinforces the theoretical and institutional finance frameworks learned in introductory business finance.

Prerequisite: B A 531

FIN 570: Financial Modeling

2 Credits

Introduces and applies equity, debt, derivative models and computational techniques using Excel and Visual Basic for Applications. FIN 570 Financial Modeling (2) This course focuses on developing models, making calculations, solving real-world problems, and applying theories. Nearly all the theories applied in this course are from the area of investment management (not corporate finance). However, the concepts, tools, and skills are immediately applicable to corporate finance (such as real option valuation, treasury and cash management, capital budgeting and cost of capital calculation, analysis of M&A and financial restructuring, financial statement and logistical simulations, and programming of routine corporate finance problems.

FIN 577: Financial Engineering and Corporate Strategy

1-3 Credits

This course provides an overview of some of the important issues and problems encountered in recognizing exposures to risk in both financial and non-financial firms, and provides students with a strategic decision-making perspective. Considerable importance will be placed on how exposures to risk affect the firm, and how risk exposures can be re-engineered to enhance firm value. An overview of financial markets and the major sources of risk exposure to the firm will be provided. Measurement of risk exposures will be discussed and various methods of managing and controlling risk will be explored. Tools of the financial engineer 'futures, options, swaps, and other derivatives' will be explained and applications will be demonstrated.

RECOMMENDED PREPARATIONS: Smeal M.B.A. Core Courses

FIN 588: Seminar in Corporate Finance Research

3 Credits

FIN 588 will provide students with a foundational doctoral-level understanding of key concepts within corporate finance such as contracting frictions, financing, investment, M&A, and corporate governance. Students will be required to demonstrate mastery of both the conceptual and methodological underpinnings of each core concept. Upon completing the course, students should be well-equipped to teach an introductory undergraduate or masters-level corporate finance course at a four-year college or Ph.D.-granting institution.

FIN 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

FIN 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

FIN 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

FIN 599: Foreign Study--Finance

1-12 Credits/Maximum of 12

FULL-TIME GRADUATE-LEVEL FOREIGN STUDY AT AN OVERSEAS INSTITUTION WITH WHOM LINKAGES HAVE BEEN ESTABLISHED.

Prerequisite: acceptance in established exchange program International Cultures (IL)

FIN 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

FIN 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

NO DESCRIPTION.

FIN 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

FIN 805: Multinational Managerial Finance

3 Credits

The course integrates macro (global financial markets) and micro (multinational enterprise-centric) dimensions within a practitioner perspective. Students are given an overview of some of the unique global business risks and opportunities facing multinationals and how these two dimensions impact corporate financial strategies. The focus will be on applying fundamental finance concepts and analytical tools for value creation and risk management applicable as they are to multinational financial management. This course aims to prepare students for a career in multinational corporate financial management in a global setting. It helps students appreciate the strategic motivations, decision processes, and valuation consequences of global financial strategies of multinational corporations. The course facilitates developing the ability among students to plan, implement, and evaluate value adding investing, financing, and risk management strategies in the context of unique opportunities and risks in the global business and financial markets.

Prerequisite: FIN 531**FIN 808: Analysis of Financial Markets**

3 Credits

This course is an overview of financial markets and institutions, with an emphasis on the valuation of fixed income securities and financial derivatives. Topics will include: determinants of interest rates; the term structure of interest rates; various financial markets including money, bond, stock, and foreign exchange markets; financial derivatives including options, futures, and swaps; and the financial markets.

Prerequisite: FIN 531**FIN 813: Speculative Markets**

3 Credits

This course covers the valuation and uses of derivative securities. The topics include the pricing and valuation of forward contracts, futures, swaps, and options. In addition, common hedging strategies will be discussed using the financial derivatives as basic building blocks to manage financial risk exposures to equity prices, interest rates, foreign exchange rates, and commodity prices. The topics in this course are quantitative and challenging because of the conceptual complexity of financial derivatives and the precision and degree of details required in pricing and valuation of derivative instruments.

Prerequisite: B A 531**FIN 855: Global Finance**

1-3 Credits/Maximum of 3

This course provides a broad exploration of international finance in the context of how a corporate strategic manager analyzes the complexities of international financial markets. In particular, the course develops a tool-kit of techniques to a) understand global market interconnectivity, b) value international financial instruments and c) analyze risk, hedging, and asset pricing strategies to secure strategic competitive advantage. Building on these insights students will gain a deep understanding of exchange rates, risk management, forecasting, and international capital flows. More specifically students will study foreign exchange markets, hedging strategies using forward and future instruments, purchasing power parity, the eurocurrency market, international portfolio

management, and the overall financial management of the international firm. Students will recognize, identify and apply the following core international finance concepts and analytical strategy tools: 1. The economics of foreign trade, the Law of One Price, and Purchasing Power Parity 2. The mechanism of Capital Flows and the effect on a country's "current account" vs. its "capital account" 3. The foreign exchange market and its influence on the pricing of tradeable goods 4. How exchange rates affect consumers vs. manufacturers of tradeable goods 5. How interest rates are determined, inflation forecasting, and how interest rate expectations influence strategic decision-making for both the firm and the individual market actor. 6. How financial instruments such as forwards, futures, swaps, and options mitigate risk and reduce earnings uncertainty 7. How to build and manage a diversified international portfolio which maximizes return relative to a multinational corporation's specific risk profile.

RECOMMENDED PREPARATIONS: Smeal M.B.A. Core Courses**FIN 871: Strategic Financial Management**

2 Credits

The course provides an integrative study of financial management utilizing applied problems and case studies. It is intended to provide both depth and breadth to students' knowledge of corporate finance. This course gives an overview of the key concepts, tools, and principles of both strategy formulation and competitive analysis utilized by the successful corporate manager. Students will analyze the dynamic business environment that successful corporate financial managers must navigate to enhance organizational performance. The skill of decision analysis is presented and then applied by focusing on how managerial decision-making affects the performance of the modern corporate enterprise. Specific topics include capital investment decision making, value creation, strategic cost management, financial performance metrics, strategic financial planning and control, strategic restructuring and growth strategies, corporate governance, and ethics.

Prerequisite: B A 531 , FIN 550**FIN 875: Fixed Income Markets**

2 Credits

Discuss the fundamentals of fixed income securities and markets. Develop tools for valuing fixed income securities and managing various sources of risks in fixed income markets. The course covers traditional bonds, the term structure concepts, and recently developed fixed income derivatives. The course emphasizes the real-world applications of the theory of fixed income securities and markets.

Recommended Preparation: Students are assumed to have some prior knowledge in finance, especially the time value of money and other related concepts. The**FIN 880: Corporate Finance Analytical Research Projects**

2 Credits

This capstone course is the culminating experience for the Master of Corporate Finance. The aim of the capstone is to assess students' ability to synthesize and integrate the skills they have developed throughout their course work. This course is structured to support student success in fulfilling program goals and requirements. The projects students tackle will mirror what they'll encounter on the job as a significant member of the corporate planning strategic management team. The course

integrates topics and methodologies analyzed throughout the program, leading students to understand that corporate strategic analysis, and ultimately, the firm's ability to enhance shareholder value, is a holistic and multifaceted analytical process. Generally, the capstone course involves strategic financial decision-making and long-term strategic analysis. The course requires students to demonstrate advanced skill at integration and mastery of specific concepts. Specifically: capital structure and cost of capital analysis, financial forecasting, valuation, corporate control, and the environmental factors influencing capital acquisition and allocation. Analysis of the international operations as a multinational firm adds an additional layer of complexity.

Prerequisite: BA 831, FIN 577, FIN 855

FIN 881: Fundamentals of Financial Markets

1-3 Credits/Maximum of 3

This course provides a broad understanding of the pricing mechanism of the bond, equity, and foreign exchange markets. The course also gives students an overview of analytical methodologies that help market participants discern asset price from asset value. How can a market participant understand when they are "buying low and selling high"? In particular, the course investigates the following questions related to understanding financial markets and why this understanding is important to success as a strategic corporate manager: ζ - What is the language of financial markets' how do market actors read financial statements with a critical eye to understand assets' future value? - What is the difference between price and value? - What, theoretically, is the "intrinsic value of an asset? What analytical techniques can the financial market participant use to approximate intrinsic value? - How are decisions made given that market results are uncertain? - How are decisions made probabilistically using the basic concepts of expected value and standard deviation? - What is the difference between an "optimal" decision using market data vs. an "accurate" decision? - How do we understand that the concept of risk is multi-layered and multi-dimensional? - Which risks are associated with which markets, i.e., bonds vs. equities etc., and how do market participants mitigate risk through hedging? - Are markets rational or are they subject to "behavioral" characteristics? - How do we understand and quantify our corporation's risk profile and how does that determine our decisions to employ capital in one asset market vs. another? At the end of the course students should have a sense that decisions to buy or sell an asset in any financial market are imperfect, and that new information alters the value of assets extremely quickly. As a result, students must develop a keen sense of how markets are moving, and why they are moving in one direction or the other. More importantly, students will realize that decisions must be made, assets must be bought or sold, and hopefully, valuation techniques lead to profitable outcomes.

Prerequisite: FIN 550 RECOMMENDED PREPARATIONS: Smeal M.B.A. Core Courses

FIN 883: Modern Portfolio Management: Theory and Practice

1-3 Credits/Maximum of 3

This course explores tools used by corporate portfolio managers. Topics covered include a review of the structure of the asset markets, basic pricing formulas, fundamental and technical analysis, and the different models relating risk and return, as well as portfolio management and derivative pricing. Statistical concepts such as mean, variance, covariance, and regression analysis will be used extensively throughout the course. In particular, corporate portfolio management has become part of the DNA of the organization. Tactically, how does strategic

management of corporate assets (both short- and long-term) i.e., the corporate portfolio, create shareholder value? In this course, students will gain an understanding of the theory underlying optimal portfolio construction, the different ways portfolios are actually built in practice, and how to measure and manage the risk of such portfolios. The course covers investment strategies for bonds, equities, and structured products, including the use of derivatives in managing risk as it relates to overall short- and long- term corporate strategy. Portfolio optimization and asset allocation are covered, as well as how to measure portfolio performance. Ethical investment, the role of taxation, and behavioral investment biases are also explored. At the end of the course students will be able to choose between different bonds, equities, and structured products, as well as make asset allocation decisions that match overall corporate strategic decision making. Students will also be able to decide on and know how to manage a diversified investment portfolio and its currency risk.

Prerequisite: FIN 550, FIN 581 RECOMMENDED PREPARATIONS: Smeal M.B.A. Core Courses

Financial Analysis - CA (FINAN)

FINAN 518: Financial Markets and the Economy

3 Credits

Operation, regulation, use, and evaluation of principal financial markets and institutions; monetary policy, asset pricing, and their effects on business. FINAN 518 Financial Markets and the Economy (3) This course will give students a thorough understanding of the major components and operation of our financial system. This system is used to finance businesses and consumer spending as well as for the management of money (payments and investments). FINAN 518 is a graduate course that adds to both your breadth (variety of topics) and depth (rigor, sophistication) of understanding of financial markets and institutions. The course consists of six inter-related major topics: \diamond Over-view of the financial system \diamond Survey and analysis of financial institutions that are used by businesses and by consumers and investors \diamond A rigorous analysis of interest rates and asset prices, including an introduction to asset pricing models \diamond An explanation and evaluation of our most important financial markets \diamond Study of important financial assets (chapters 16-25) that are used by businesses to raise funds and are used by investors to increase their wealth and income \diamond An introduction to the relatively new, and growing, markets for financial derivatives, covering the pricing of derivatives (principally futures and options contracts and their use for hedging price risk and for speculation)

Prerequisite: BUSEC502 and BUSEC503

FINAN 521: Corporate Finance

3 Credits

An in-depth analysis of concepts and techniques of corporate financial management.

Prerequisite: ACCT 501

FINAN 522: Investment and Portfolio Management

3 Credits

Investment analysis and portfolio management theory and applications.

Prerequisite: FINAN521

FINAN 523: Risk Management of Modern Financial Institutions

3 Credits

Evaluating and managing risks faced by modern financial institutions in a dynamic financial market.

Prerequisite: FINAN521**FINAN 526: International Finance**

3 Credits

Basics of corporate finance extended to the international environment through a special consideration of exchange rate behavior and its management.

Prerequisite: FINAN521**FINAN 527: Derivative Securities**

3 Credits

Use of financial futures, options, and swaps for risk management and investment; pricing models, trading strategies hedging price risk.

Prerequisite: FINAN521**FINAN 530: Corporate Finance II**

3 Credits

In-depth analysis of capital budgeting, mergers and acquisition, raising capital, leasing, working capital management, risk management, and international finance.

Prerequisite: FINAN 521**FINAN 531: Managing Financial Operations**

3 Credits

A course for financial managers: working capital management, financial planning, financial controls, reporting, financial strategies; theory and practice.

Prerequisite: FINAN521**FINAN 596: Individual Studies**

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

FINAN 596A: Independent Study Investment Portfolio Management

3 Credits

Investment analysis and portfolio management theory and applications.

FINAN 597: Special topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

Food Science (FDSC)

FDSC 500A: Fundamentals of Food Science - Microbiology

1 Credits

Overview of the field of Food Science with the focus on microbiology. FD SC 500A Fundamentals of Food Science - Microbiology (1) An overview of the field of food microbiology required of all entering graduate students majoring in food science. Students will acquire knowledge of the core concepts pertaining to the general topics of food microbiology. Upon completion, the student will be familiar with the primary sources of information related to the field. The course provides background material for more advanced and specialized graduate-level courses in food science and will be offered each fall semester.

FDSC 500B: Fundamentals of Food Science - Engineering

1 Credits

Overview of the field of Food Science with the focus on engineering. FD SC 500B Fundamentals of Food Science - Engineering An overview of the field of food engineering required of all entering graduate students majoring in food science. Students will acquire knowledge of the core concepts pertaining to the general topics of food engineering. Upon completion, the student will be familiar with the primary sources of information related to the field. The course provides background material for more advanced and specialized graduate-level courses in food science and will be offered each fall semester.

FDSC 500C: Fundamentals of Food Science - Chemistry

1 Credits

Overview of the field of Food Science with the focus on chemistry. FD SC 500C Fundamentals of Food Science - Chemistry (1) An overview of the chemistry underlying the properties of food. Students will be introduced to the major chemical components of food along with the reactions occurring during manufacturing and storage that can impact food quality and safety. The material will be taught through a combination of lectures and selected readings pertaining to the field of food chemistry. Upon completion, students will be able to explore how these topics can be practically addressed as research questions through the analysis of papers from recent guided readings. The course provides background material for more advanced and specialized graduate-level courses in food science and will be offered each spring semester.

FDSC 500D: Fundamentals of Food Science - Nutrition

1 Credits

Overview of the applications of nutrition in the field of Food Science. FD SC 500D Fundamentals of Food Science - Nutrition An overview of the role that nutrition research and recommendations play in labeling regulations and product development of manufactured foods. The student will acquire a very basic understanding of human carbohydrate, protein and fat metabolism and how the public health concern about chronic disease has influenced the Nutrition Facts panel and the use of health claims. Case studies of several functional ingredients (including fat replacers) developed by the food industry in response to nutrition recommendations will be examined.

FDSC 501: Research Methods in Food Science

2 Credits

Planning and conducting research in food science including: problem definition, experimental design, collecting and recording data, and effective communication. FD SC 501 Research Methods in Food Science (2) FD SC 501 is designed to develop and improve research skills and prepare students for professional careers. The course will guide the student from problem selection to a completed research report. Along the way the student will come to appreciate the philosophical underpinnings of the research enterprise and understand how a research project is conducted in a professional and acceptable manner. The course will provide an overview of statistical techniques used for data analyses and protocols necessary to conduct research using human and animal subjects. Emphasis will be given to learning and improving written and oral communication skills. Students will learn by identifying funding sources, writing a research grant proposal and presenting the same to an audience. Subtleties of writing skills for peer-reviewed journals and corporate reports will be highlighted. Performance in the course will be evaluated based on written and oral presentations and class participation. A variety of audio-visual tools will be available to make presentations in the class. The course will be offered every spring semester.

FDSC 506: Flavor Chemistry

3 Credits

Formation, analysis and release of flavors in food systems.

Prerequisite: FD SC400

FDSC 507: Advanced Food Microbiology

3 Credits

Roles of microorganisms in food preservation, spoilage, health and disease. Recent advances in detection, tracking and control of foodborne pathogens. FD SC 507 Advanced Food Microbiology (3) FD SC507 is an intensive graduate course in food microbiology. Students will acquire knowledge of the core concepts pertaining to the roles of microorganisms in food preservation, spoilage, human health and disease. Special emphasis will be given to recent advances in molecular biology, genomics and bioinformatics that enhance the detection and tracking of foodborne pathogens. Upon completion of the course, students will be able to critically evaluate primary sources of information related to the field and be able to apply their knowledge to the development of effective risk assessment and risk management systems for ensuring food safety. Students will be able to critically analyze current food microbiology research publications and assess the quality of research publications in the field of food microbiology. Performance will be assessed through two exams, two quizzes, presenting and leading critical discussions of journal articles, and participating in class discussions. Resources will include an advanced-level text, other hardcopy and electronic resources and primary literature. The course will be offered every other year during the spring semester.

Prerequisite: FD SC408 or FD SC500A , and a 400-level course either biochemistry or molecular biology

FDSC 510: Carbohydrate Hydrocolloids

3 Credits

Physicochemical behavior of edible carbohydrate hydrocolloids, with emphasis on starch and selected exudates, extracts, flours, and fermentation products.

Prerequisite: BIOCH401

FDSC 511: Enzymes in Food

3 Credits

The food enzymes market is currently worth billions of dollars while being projected to continue to experience robust growth rates for the foreseeable future. Enzymes are thus becoming an increasingly important part of the food industry, either allowing for new processes or replacing existing chemical catalysts. As consumers become more wary of chemicals added to their foods, enzymes are increasingly being viewed as a more natural solution to food processing challenges. Besides these added enzymes, many foods contain their own enzymes that contribute to and present challenges with food quality and stability. Furthermore, microorganisms responsible for food fermentations and spoilage of foods contain their own enzymes that are ultimately driving these processes. In this course students will learn about the use and manipulation of enzymes in the food industry during processing and fermentation as well as those enzymes naturally present in food and present in spoilage organisms and food borne pathogens. Students will come away from this course with knowledge about the chemistry catalyzed by these enzymes and how they can be exploited and controlled in the food industry to achieve the desired food quality and stability. This will include deeper investigations into both key enzymes in food processing and those of particular relevance to the students; research through paper discussions and student-led discussions of relevant enzymes. Thus, students will finish this course better prepared not only to tackle enzyme-related challenges in the food industry, but also aspects of their own research projects that involve enzymes.

Recommended Preparations: It is recommended that students have taken an introductory biochemistry course.

FDSC 514: Food Physical Chemistry

3 Credits

Physical principles underlying food structure and quality. FD SC 514 Food Physical Chemistry (3) Food structure occurs over many scales ranging from the molecular to the macroscopic pieces consumed. We are interested in small scale behaviors as they determine larger scale structures and hence the bulk functionality of foods as materials (e.g., texture, physical stability). The structure of food arises from the molecular interactions of its ingredients as modified by the processing conditions applied. Food is rarely at a thermodynamic equilibrium so time-dependency and kinetics are particularly important. In this class, the students will develop an understanding of the structures occurring (e.g., crystals, gels, colloids), how they form, and how they affect the functional properties of foods. Students will gain knowledge and understanding of the relevant principles through a variety of guided readings and lectures. They will then apply this knowledge in critical discussions of primary research articles. Finally the students will use the knowledge gained in a research project where they will be asked to explain the physics associated with a specific food product or process. Students will be

evaluated by a combination of in-class tests, a participation grade, examinations (mid-term and final) and a project. The course will be offered alternating spring semesters.

Prerequisite: FD SC400 or FD SC500C

FDSC 515: Sensometrics - Applied Multivariate Analysis in Sensory & Food Science

3 Credits

The main objective of this course is to allow each student to develop the necessary data analysis skills needed for analyzing and interpreting sensory and consumer data. Additionally, students will develop an understanding for experimental designs and statistical analyses to plan, analyze, and interpret data collected from sensory studies. Hands-on experiences in analyzing sensory data will be provided through homework assignments in each week, and discussions of appropriate literature where indicated. Topics covered in this course will include experimental design and data visualization, data analysis of discrimination tests, analysis methods for descriptive data, approaches for understanding consumer results and identifying drivers of liking, as well as novel statistical methods for alternative descriptive methods (sorting, napping, check-all-that-apply, etc.), ways of analyzing temporal sensory data, and correlating sensory data to other data, such as demographics or instrumental analyses. Discussion of current literature, where appropriate, will showcase how these methods are applied in the "real world", and further the understanding of how these methods are used, and interpreted. In addition, students will develop and further their critical thinking and communication skills.

Prerequisite: STAT 500; or BBH 505 **RECOMMENDED PREPARATIONS:** STAT 484 STAT 485 FDSC 404

FDSC 516: Consumer Insights

3 Credits

This course aims to allow each student to develop and apply the fundamental dimensions and value of consumer insights to product development objectives; implement key qualitative, quantitative, and hybrid approaches for consumer insights; recognize, identify, and apply key consumer biases, and examine trade-offs in research and consumer behavior. Topics covered in the course start with understanding the consumer and key consumer biases and move to objective-based consumer research design including qualitative, quantitative, and hybrid approaches. In addition, research in the fuzzy front end, utilizing social listening as well as new technology in consumer research will be discussed. Throughout, an objective-based framework will be applied where the consumer is at the center and insights are developed related to how consumer interact with products. In addition, the real-world practical examples and assignments will be utilized extensively for real world application. Taken together, this will allow students to develop and further their critical thinking and communication skills.

CONCURRENTS: STAT 500

FDSC 517: Microbial Genomic Epidemiology

3 Credits

This course gives students an overview of the sequencing technologies and genomic sequence data analyses (e.g., sequence pre-processing, assembly) and demonstrates their application in the context of epidemiology (e.g., identification of single nucleotide polymorphisms

and genes of interest). The course covers the concepts necessary to carry out comparative genomics analyses and interpret the results in the context of an outbreak investigation. These concepts are then applied in a practical sequence-analyses case study focused on the development of prokaryotic whole-genome sequence data analysis skills. Lastly, students are guided in the application of gained knowledge and skills through final projects.

Recommended Preparations: Students are recommended to complete a 400-level course in microbiology, molecular biology, or biochemistry prior to taking this course

FDSC 521: Food Defense: Prevention Planning for Food Processors

3 Credits

Course prepares current and aspiring professionals to learn, recognize and apply measures to prevent intentional contamination of the food supply. FD SC (AGBIO) 521 Food Defense: Prevention Planning for Food Processors (3) This course will not only provide participants with knowledge of the domestic and international food industry, but it also provides tools for food industry and homeland security professionals to develop food defense programs to protect the food supply from terroristic activities leading to intentional contamination. The course will introduce and apply: examples where intentional contamination has been used in the food industry; biological, chemical and physical hazards of primary concern in the food industry; methods for detecting hazards in the food supply; systems employed to monitor foodborne illness in the general public; management practices employed in food production to deal with recalls and other crises; vulnerabilities and mitigation procedures unique to food production; as well as agencies, resources, and tools needed to protect, prepare, and respond to intentional contamination incidents. This course is a required course for the certificate program in Agricultural Biosecurity as well as the Master of Professional Studies in Homeland Security/Agricultural Biosecurity Option. These principles also will be incorporated into a food defense plan, recall plan, and emergency preparedness plan for an assigned food establishment.

Cross-listed with: AGBIO 521

FDSC 525: Culture Based Analysis of Microorganisms

3 Credits

In a world where genomics/metagenomics techniques are becoming increasingly prevalent our knowledge about the genetic potential of organism is far outstripping our knowledge about how these organisms utilize this potential during growth. It is becoming more important than ever to design and execute culture-based experiments to test the hypotheses generated from our genetic knowledge of these bacteria. This course has been developed to teach students to design and execute culture-based experiments and to complement courses tailored to studying organisms from genetic and ecological perspectives. Additionally, there have been exciting developments in microbial culture that are allowing much of the diversity of microorganisms that are being discovered to be cultured for the first time. This course will explore the culture of microorganisms from both a theoretical and practical perspective with two lectures and one lab per week. Students will learn about culturing bacteria from diverse environments and with a variety of growth requirements using both traditional and cutting-edge methods. The design of experiments involving culturing bacteria will be a key focus and students will design their own culturebased experiment to explore a question of interest. Overall, the learning objectives for students taking the course are: 1) Be able to describe the key factors that determine the

culturability of a microorganisms and methods for developing successful culture conditions, 2) Design experiments to isolate and or investigate bacteria of interest in a culture dependent manner, 3) Analyze data derived from bacterial cultures. These objectives will be explored in the context of monocultures, co-cultures and complex community cultures of microorganisms, which will leave students with the tools to answer a wide variety of questions using culture-based techniques.

Recommended Preparations: It is recommended that students have completed an introductory microbiology course.

FDSC 526: Microbial Physiology of Foodborne Organisms

3 Credits

A current literature-based course investigating the mechanisms by which foodborne bacteria (beneficial and pathogenic) grow, survive, and react to environments encountered in foods and during food processing.

FDSC 534: Readings in Ingestive Behavior

1 Credits/Maximum of 6

Students lead discussions of original research in the field of ingestive behavior; focus on food intake in particular. FDSC 534 / NUTR 534 Readings in Ingestive Behavior (1 per semester/maximum of 6) The class provides a forum for students to learn to lead a discussion focused on original research in the field of ingestive behavior. In addition, it provides the opportunity for students to become familiar with the broad range of topics relevant to this field of research. While the primary focus is on the consumption of food, other relevant topics (obesity, eating disorders, fluid intake) also are included. Research topics include both basic and applied areas.

Cross-listed with: NUTR 534

FDSC 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on individual basis and fall outside the scope of formal courses.

FDSC 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

FDSC 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

FDSC 601: Ph.D. Dissertation Full Time

0 Credits/Maximum of 999

No description.

FDSC 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Supervised experience in the development of instructional materials, the organization and conduct of lectures/laboratories, the evaluation and counseling of students.

FDSC 603: Foreign Academic Experience

1-12 Credits/Maximum of 12

Foreign study and/or research approved by the food science program constituting progress toward the degree.

FDSC 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

FDSC 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

Forensic Science (FRNSC)

FRNSC 532: Drug Chemistry and Toxicology

3 Credits

Chemical and toxicological properties of therapeutic and non-therapeutic drugs and the analytical and instrumental methods of their identification and quantification.

FRNSC 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

FRNSC 801: Professional Development in Forensic Science

3 Credits

This course prepares students to obtain professional employment in forensic science or an allied field. This includes preparation for background investigations, behavioral-based interviews, and civil-service employment practices. This course also prepares students for forensic laboratory management roles in the future, including human resources management, laboratory safety, quality assurance and evidence-submission triage. Quality assurance/quality control, professional conduct, ethical standards development, and laboratory safety are also discussed. Students' education in forensic science is finalized through case integration exercises. These exercises prepare students to incorporate available information into the investigative process and to serve as consultants to the criminal justice system. Students also prepare to sit for a comprehensive exam, covering the full content of coursework across the scope of the Forensic Science Program. This will be administered using the Forensic Science Assessment Test (FSAT) offered by the American Board of Criminalistics (ABC) or its equivalent.

Concurrent Courses: FRNSC 821 or FRNSC 831

FRNSC 821: Forensic Molecular Biology II

4 Credits

Advanced concepts and application of molecular biology techniques to the analysis of biological evidence collected at crime scenes. FRNSC 821 Forensic Molecular Biology II (4) Classroom discussions will expand on the application of forensic DNA analysis using all market types (STR, Y-STR, and mtDNA), including interpretation of complex profiles and mixtures, advanced understanding of instrument operation, and presentation of DNA results in the courtroom. Students will be introduced to technologies that could be applied in forensic laboratories in the near future (e.g., SNP's, micro-capillary arrays, microchips), and will gain an advanced understanding of how forensic DNA laboratories operate and are managed; i.e., quality assurance programs, facility security, proficiency testing programs, basic budgetary and financial issues, and other areas of interest. The laboratory exercises will reflect classroom discussions and students will be expected to prepare courtroom ready materials (data, documents, and demonstrations). The students will be responsible for setting up and running the laboratory in a similar manner to how a real crime laboratory is run. Many of the classroom discussions will be problem solving exercises designed to emphasize specific applications of laboratory analysis. At the end of the course, students will have mastered advanced screening techniques and the three major forensic DNA methods for analyzing biological evidence. Additionally, they will be prepared to work in a forensic DNA crime laboratory, understanding quality assurance, accreditation, and other areas of importance. In the laboratory, students will have analyzed difficult sample types, interpreted complex DNA profiles, and prepared the evidence for advanced levels of courtroom testimony. The proposed course is relevant to any student in the forensic sciences who has an interest in obtaining employment in a local, state or federal law enforcement agency and/or crime laboratory facility. This is an 800-level forensics course that will be required for students in the Master of Professional Studies (MPS) in Forensic Science degree program who are interested in forensic biology.

Prerequisite: FRNSC421W**FRNSC 831: Forensic Chemistry II**

4 Credits

This is a classroom and laboratory-based course designed as a practical course to provide the students with advanced skills and understanding to perform forensic chemical analysis. The focus of the course will be on Chemical processes for extraction of target chemicals from different matrices, advanced chromatographic theory, optimization of HPLC, LC/MS and GC/MS methods, and Instrument design, maintenance, and troubleshooting. We will end with a section on NMR analysis. The course will rely heavily on the students' knowledge and skills that have been learned or acquired during their studies in prerequisite course work. The prerequisite knowledge includes, but is not limited to algebra, calculus, general chemistry, organic chemistry, analytical chemistry, basic statistics, spectroscopy theory, chromatography theory, proper evidence handling practice, and good writing skills. The learning objectives and outcomes are primarily focused on preparing the students to be capable and competent scientists with sufficient knowledge to work with HPLC, GC/MS, IR, and LC/MS. The student will also become familiar with extraction theory and techniques used in identification and characterization of chemical substances. The student will gain experience and understanding in effective analysis and interpretation of

data and observations and will gain critical thinking skills for determining significance of data as forensic evidence.

Prerequisite: FRNSC 427W and FRNSC 415W**FRNSC 841: Forensic Seminar Series**

1 Credits

Classroom presentations and discussions will focus on different aspects of forensic science as found in current journal articles, casework studies, and current research projects. In this course the student will be exposed to reviewing various forms of technical literature (Manuscript Categories), and then give a discussion of the purpose of each. The students will research the various categories and read articles/manuscripts, assess, critique and present a paper relative to articles pertaining to their research. The students will then research the various categories and read articles/manuscripts, assess, critique and present a paper with no relation to their research. At the end of the course, students will have gained an understanding or better understanding of a number of different forensic science concepts.

FRNSC 861: Ethics in Forensic Science

1 Credits

Classroom presentations and discussions will focus on integrity, ethical behavior, ethics standards and different examples of ethics violations and misconduct in the forensic science community. In this way, the students will be introduced to the imperative and sensitive issues surrounding professional integrity and ethics. At the end of the course, students will have gained an understanding or better understanding of professional integrity and ethical behavior in relation to forensic science.

FRNSC 894: Research Projects in Forensic Science

1-12 Credits/Maximum of 12

Supervised student research projects identified on an individual or small-group basis.

Forestry (FOR)**FOR 508: Forest Ecology**

3 Credits

The forest ecosystem, variations in space and time, classification, ordination techniques, dynamic aspects such as energy flow and nutrient cycling.

FOR 517: Ecology of Plant Roots

2 Credits

This course covers the form and function of roots from an ecological perspective. Emphasis is placed on identifying and interpreting the diversity of root strategies used by plants to meet the essential functions of water and nutrient acquisition, transport, storage and structural support under various environmental conditions. Additional topics include how root systems may modify ecosystem processes associated with carbon, mineral nutrient and water cycles. Specialized topics include cost/benefit analysis, root evolution, root architecture, root herbivory-defense, mycorrhizas, root respiration, root longevity, resource

competition and interference and weathering and soil formation. Both wild and crop plants are discussed.

FOR 521: Advanced Silviculture

3 Credits

Specific silvicultural practices for the establishment and manipulation of forest stands with respect to recent developments and research needs.

Prerequisite: FOR 421

FOR 530: Conservation Genetics

3 Credits

Discussion of the use of genetic principles and technologies in the conservation and management of biological diversity. FOR 530 Conservation Genetics (3) This course will familiarize students with the roles of population genetics, phylogenetics, molecular genetics and quantitative genetics in conservation biology, and to examine in depth pertinent examples from the literature dealing with current applications of conservation genetics including genetic diversity, genetics at the landscape level, the effects of fragmentation on the genetic structure of species, and the role of modern genetics within ecosystem management. FOR 530 will provide a new and valuable component to the graduate curriculum of students interested in genetics, forestry, wildlife, fisheries, conservation, and endangered species. The current scientific literature will be critically reviewed and discussed in relation to case studies, on a range of topics. Evaluation will be based on participation, class presentations, and written papers. The course is to be offered biennially in the Spring in even numbered years.

Prerequisite: FOR 430

FOR 555: Multispectral Remote Sensing

3 Credits

Computer analysis of data from nonimaging remote sensors as applied to mapping of natural resources and land use.

Prerequisite: three credits of remote sensing

FOR 565: GIS Based Socio-Ecological Landscape Analysis

3 Credits

GIS-based socio-ecological analysis of landscape context for natural resources in relations to present and prospective patterns of land use. FOR 565 GIS Based Socio-Ecological Landscape Analysis (3) This course seeks synthesis to bridge a gap between the contemporary spatially-oriented biophysical analysis of landscape ecology and use of geospatial technologies for analysis of past, present, and prospective human influences operative at landscape scale - both of which use geographic information systems as analytical platforms. Interest is reciprocal - human influences on landscape, and landscape conditioning of human economic development. Instruction takes place in a GIS laboratory facility, and evidence of learning arises from ability to access, manipulate, and display spatial information.

Prerequisite: one course each in intro GIS and statistics

FOR 570: Watershed Stewardship Practicum I

3 Credits

Application of integrated community-based watershed planning for water resources management.

Prerequisite: enrollment in the Graduate Option in Watershed Stewardship

FOR 571: Watershed Stewardship Practicum II

5 Credits

Application of integrated community-based watershed planning for water resources management.

Prerequisite: FOR 570 and enrollment in the Graduate Option in Watershed Stewardship

FOR 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

Cross-listed with: SOILS 590, WFS 590

FOR 591A: Seminar in Watershed Stewardship Issues

1 Credits

Exploration of watershed stewardship issues.

Prerequisite: enrollment in the Graduate Option in Watershed Stewardship or by permission of the instructors

FOR 591B: Seminar in Watershed Stewardship Planning

1 Credits

Exploration of watershed stewardship planning processes.

Prerequisite: enrollment in the Graduate Option in Watershed Stewardship or by permission of the instructors

FOR 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

FOR 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

FOR 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

FOR 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

FOR 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Provides an opportunity for supervised and graded teaching experience in forestry courses.

FOR 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

FOR 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

FOR 880: Bioenergy Feedstocks

3 Credits

This course comprehensively addresses the characteristics, production, and improvement of plants as feedstocks for conversion to energy.

Prerequisite: A B E884

French (FR)

FR 501A: Pro-Seminar in French Studies I

1.5 Credits/Maximum of 3

Professional and scholarly development in interdisciplinary French Studies.

FR 501B: Pro-Seminar in French Studies II

1.5 Credits/Maximum of 3

Professional and scholarly development in interdisciplinary French Studies.

Prerequisite: FR 501A

FR 502: Introduction to French Linguistics

3 Credits

An overview of the major subfields of linguistics as they apply to the French language.

FR 529: Seminar in Renaissance Literature

3 Credits/Maximum of 6

Intensive study of various French Renaissance writers in relation to selected artistic issues of the period.

FR 530: La France Contemporaine

3 Credits

A comprehensive cross-sectional view of French society and its institutions since World War II.

FR 531: Francophone Culture

3 Credits/Maximum of 6

Concept of francophone; French minorities in Europe and North America; role of French language in Africa, Middle East, Far East.

FR 533: Baroque Aesthetics in Seventeenth-Century French Literature and Intellectual History

3 Credits

Based on the Foucauldian notion of episteme, the course analyzes major literary texts and intellectual trends.

FR 535: Texts and Performances

3 Credits

Based upon current theories of theater, the course focuses on problematics of French drama from the Seventeenth-Century to the present.

FR 543: Seminar: Studies in the Enlightenment

3 Credits/Maximum of 6

Discourse and thematic analysis of selected works of French Enlightenment genres: essay, drama, fiction, poetry.

FR 545: Analysis of French Civilization

3 Credits/Maximum of 6

French cultural aspects, other than language and literature, conducted in French with the collaboration of specialists outside the French department.

FR 546: Discourses on Decadence, 1870-1914

3 Credits

This interdisciplinary seminar examines notions of decadence in the visual arts and other fields elaborated primarily in French and Francophone contexts between 1880 and 1914. We will alternate an in-depth reading of Joris-Karl Huysmans' classic text of *Decadence*, *A Rebours* (1884), with close study of the visual arts, music, scientific discourse, and historical and philosophical texts in order to identify what were considered by contemporaries the major sources of decadence during that era: among others, 'new women,' Jews and other social and 'racial' inferiors, democratization, urbanization, and the triumph of scientific and rationalistic thought. We will also examine presumed symptoms of decadence: neurasthenia, declining birth rates, perceived social 'pathologies' such as prostitution, crime, and drugs; homosexuality, androgyny, and other supposed sexual 'perversions'; and psychological conditions such as hysteria. Finally, we will examine what contemporaries considered antidotes to decadence: visits to spas, the cult of heroes, sports, a return to faith. We will analyze how artists and authors of the period among others, Aubrey Beardsley, Félicien Rops, Edvard Munch, Fernand Knopff, Jean Lorrain, Oscar Wilde, and others' valorized the

notion of decadence, celebrating it and making it the touchstone of a key esthetic of the late-nineteenth century, overlapping and echoing other trends and esthetics, such as Symbolism, Art nouveau, the Pre-Raphaélites, Japonism, the Arts and Crafts Movement, Jugendstil, Estheticism, Dandyism, and Snobbism

FR 547: Modernism and Postmodernism

3-6 Credits/Maximum of 6

Interdisciplinary approaches to these concepts, with a focus on artistic and literary objects in the French context.

Prerequisite: FR 545 or FR 571 or FR 580

FR 559: Issues in Francophone Literatures

3 Credits

Diversity issues in Francophone literatures explored through various literary genres: variable focus may combine genre and topic.

FR 562: French Romanticism and Realism

3 Credits

Romanticism, realism, and their variations in the context of social and political revolution.

FR 564: Figures of Alterity in Nineteenth-Century French Literature

3 Credits

Representations of otherness in nineteenth-century French literature examined through race, gender, religion, and class paradigms.

FR 565: Seminar: Nineteenth-Century Studies

1-6 Credits

Various nineteenth-century French writers considered in relation to selected esthetic and cultural problems raised during the period.

FR 566: Women Writers in Nineteenth-Century France

3 Credits

Women's literary production in nineteenth-century France, including novels, poetry, travel narratives, children's literature, and essays.

FR 569: Major Texts of Twentieth-Century French Literature

3-6 Credits/Maximum of 6

Established contemporary literary texts, figures, and aesthetic movements in various genres from Proust to Sartre and from Genet to Conde.

FR 570: Modern French Poetry

3 Credits/Maximum of 6

Exploration of the poetic genre and its diversification through poetic prose, free verse, and metaphorical narrative, from Baudelaire to Cixous.

FR 571: French Literary Theory and Criticism

3 Credits

Major trends in contemporary theory and criticism from genre debates to socio-political approaches to literature, post-structuralism, deconstruction, and reception theories.

FR 572: Seminar: Twentieth-Century French Literature

3 Credits/Maximum of 6

Specialized consideration of contemporary writers; for advanced students.

FR 580: Approaches to French Civilization

3 Credits

French interdisciplinary methods of cultural analysis and cultural history, with applications to French cultural artifacts.

FR 581: Theory and Techniques of Teaching French

1-6 Credits/Maximum of 6

No description.

FR 589: Technology in Foreign Language Education: An Overview

3 Credits

Approaches to the uses and research applications of multimedia and other educational technologies applied to the teaching of foreign languages. (also crosslisted with SPAN 589)

Cross-listed with: APLNG 589, CMLIT 589, GER 589, SPAN 589

FR 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

FR 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

FR 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

FR 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

FR 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Activities to be included in the teaching assignment will be lecturing, leading discussions, conducting recitations, correcting and grading student papers and examinations.

FR 603: Foreign Academic Experience

1-12 Credits/Maximum of 12

Foreign study and/or research constituting progress toward the degree at a foreign university.

FR 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

FR 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

Fuel Science (FSC)

FSC 503: Analytical Methods in Fuel Science

3 Credits

Analytical and characterization methods used in fuel science and applied to fuel processing, combustion, and conversion are emphasized. F SC 503 Analytical Methods in Fuel Science (3)The course will focus on the analytical methods that are used in fuel science for the characterization of fuels and their products during combustion, conversion, processing, and utilization. Students will be exposed to the theory and practical applications of such analytical methods as chromatography and spectrometry. Methods for the analysis of the data obtained with these analytical techniques will be discussed. In particular, the potential for interference and confounding results and techniques for establishing reproducibility and error bars in the experimental data and results will be explored.

Prerequisite: EGEE 430 , F SC 431 or equivalent**FSC 504: Problems in Fuels Engineering**

3 Credits

A problem-based, active learning course on the utilization of fossil fuels and renewable energy.

Prerequisite: EGEE 430 and F SC 431**FSC 506: Carbon Reactions**

3 Credits

Current approaches to heterogeneous reactions in combustion and gasification of carbonaceous solids, including those derived from coal and petroleum sources.

Prerequisite: CHEM 452**FSC 596: Individual Studies**

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

FSC 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

FSC 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

Genetics (GENET)

GENET 581: Genetics of Model Organisms: Bacterial and Viral Pathogenesis: A

1 Credits

Examines uses of genetic studies in understanding biological processes associated with bacterial and viral pathogenesis. GENET 581 GENET 581 Genetics of Model Organisms: Bacterial and Viral Pathogenesis: A (1) This course presents the use of genetic analysis in bacteria and viruses with its application to the study and dissection of biological pathways and processes. Bacterial and viral pathogenesis will be used to develop concepts and techniques that are critical components of genetic studies. Integration of studies will be used to compare and contrast the specific methods and techniques that underlie the use of genetic approaches in bacteria and viruses.

Prerequisite: BMS 503 or permission of program**GENET 582: Genetics of Model Organisms: Molecular Genetic Analysis of Signaling Pathways: B**

1 Credits

Examines uses and interrelationships of genetic studies with model systems from yeast to mice in elucidating signaling pathways. GENET 582 GENET 582 Genetics of Model Organisms: Molecular Genetic Analysis of Signaling Pathways: B (1) This course presents the use of genetic analysis in model organisms and systems with its application to the study and dissection of biological pathways and processes. elucidation of target of rapamycin (TOR) signal transduction pathway will be used to develop concepts and techniques that are critical components of genetic studies. Integration of studies from multiple model systems will be used to compare and contrast the specific methods and techniques that underlie the use of similar genetic concepts in different organisms and systems.

Prerequisite: BMS 503 or permission of program**GENET 585: Human Genetics B: Non-mendelian Genetics**

1 Credits

This course explores genetic disease mechanisms that alter chromosome behavior or show non-mendelian patterns of inheritance. GENET 585 GENET 585 Human Genetics B: Non-mendelian Genetics (1) Many genetic diseases do not show straightforward patterns

of inheritance. Was Gregor Mendel wrong? How can a disorder be inherited without causing primary DNA sequence changes? What is the biological basis behind disorders that do not show simple mendelian inheritance? What are the phenotypic consequences of disorders that alter fundamental aspects of chromosome mechanics? These topics and more will be covered in this selective course. This course will be offered as part of 3 one-unit courses in Human Genetics that cover (1) identification and analysis of chromosomes and disease genes, (2) the human genome and complex traits, and (3) chromosome behavior and non-mendelian inheritance. The full three unit series may be taken in its entirety although each one-unit course is completely independent of the other two courses. Students will be evaluated by their class participation and performance on take-home assignments that require the students to solve problems, evaluate experiments, or logically address research questions.

Prerequisite: BMS 501 , BMS 502 , and BMS 503

GENET 586: Human Genetics C: Complex Traits

1 Credits

This course explores the human genome landscape, how individuals vary, and gene identification for multigenic traits and disorders. GENET 586 Human Genetics C: Complex Traits (1) With the completion of the human genome project, genes underlying almost all "simple" mendelian traits have now been identified. A new challenge is to identify genes involved in common traits and disorders such as hypertension or obesity. This course will explore the human genome landscape, human genome variation, principals of population genetics and experimental approaches to identify genes involved in these important complex disorders. This course will be offered as part of 3 one-unit courses in Human Genetics that cover (1) identification and analysis of chromosomes and disease genes, (2) the human genome and complex traits, and (3) chromosome behavior and non-mendelian inheritance. The full three unit series may be taken in its entirety although each one-unit course is completely independent of the other two courses. Students will be evaluated by their class participation and performance on take-home assignments that require the students to solve problems, evaluate experiments, or logically address research questions.

Prerequisite: BMS 501 , BMS 502 , and BMS 503

GENET 587: Genetic Approaches to Biomedical Problems

3 Credits

Advanced training of students with interest in genetic approaches to problem solving.

Prerequisite: BMS 501 , BMS 502 , BMS 503

GENET 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

GENET 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

GENET 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

GENET 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

GENET 601: Ph.D. Dissertation Full Time

0 Credits/Maximum of 999

No description.

GENET 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

Geodesign (GEODZ)

GEODZ 511: Geodesign History, Theory, Principles

3 Credits

Students study the theory and principles of geospatially-based design by investigating the methods and collaborative nature of the geodesign process. GEODZ 511 Geodesign History, Theory, Principles (3) GEODZ 511 consists of lectures, readings in course literature, small group discussion forums, and individual topic investigation. In this course students will explore the questions, challenges, and the values of the geodesign framework. The course provides a comprehensive overview of the geodesign process, including designing in geographic space, issue identification, process evaluation, fast iteration and alternative scenario generation, multidisciplinary collaboration, and the role of science- and value-based decision making. The course culminates in a final project in which students independently research the physical and social characteristics, data, and teaming-expertise required to deploy a study for their topic, and report on how their proposed geodesign framework enables creative change for that location. Students who successfully complete the course will be able to associate different types of design and planning issues and challenges to the appropriate geodesign workflow and identify possible models to use to promote creative change for a place. They will be able to prepare a description of a scenario and the team needed to perform a geodesign study, and illustrate which tools or techniques may be best suited for a scenario.

GEODZ 596A: Individual Studies--Geodesign Capstone Project Proposal and Peer Review

3 Credits

Preparation and peer-review presentation of proposal for an individual capstone geodesign project.

Prerequisite: GEODZ852

GEODZ 596B: Individual Studies--Geodesign Capstone Project Dissemination

3 Credits

Preparation and dissemination of geodesign capstone project results in a formal professional venue.

Prerequisite: GEODZ596A

GEODZ 822: GeoDesign Models I: Evaluation and Decision

3 Credits

The principles, inherent values and practical applications of Evaluation and Decision models as implemented within the Geodesign Framework.

Prerequisite: GEODZ511

GEODZ 824: GeoDesign Models II: Process and Impact

3 Credits

The principles, inherent values and practical applications of Process and Impact models as implemented within the Geodesign Framework.

Prerequisite: GEODZ822

GEODZ 826: GeoDesign Models III: Representation and Change

3 Credits

The principles, inherent values and practical applications of Representation and Change models as implemented within the Geodesign Framework.

Prerequisite: GEODZ822

GEODZ 842: Geodesign Studio I: Rural/Regional Challenges

6 Credits

Problems-based workshop where students apply geodesign process, in a collaborative setting, to regional-scale landscape change and land planning topics.

Prerequisite: GEODZ824 or GEODZ826

GEODZ 852: Geodesign Studio II: Urban/District-scale Challenges

6 Credits

Problems-based workshop where students apply geodesign process, in a collaborative setting, to urban-scale landscape change and land planning topics.

Prerequisite: GEODZ842

Geography (GEOG)

GEOG 500: Introduction to Geographic Research

1-3 Credits/Maximum of 3

No description.

GEOG 502: Research Scholarship in Geography

3 Credits

Learning the craft of scholarly research in geography. GEOG 502 Research Scholarship in Geography (3) Graduate students are expected to make a significant research contribution as part of the requirements for a MS or Doctoral degree in Geography. The Research Scholarship in Geography course provides students with a basic understanding of the craft of scholarly geographic research. It does so by setting research into a tradition of commonalities that shape expectations (e.g., disciplinary and federal IRB ethics standards; ideas of academic freedom and responsibility) and by focusing on the mechanics of key steps in the research process (identifying problems, developing questions and proposals, designing programs of research, executing a systematic program of research, responding to criticism and to opportunities, preparing and delivering oral presentations, and writing and publishing research reports). The course emphasizes important skills in developing research proposals, seeking research funding, writing manuscripts, giving presentations, and publishing research results.

Prerequisite: GEOG 500

GEOG 508: Feminist Methodology

3 Credits

The objective of this course is to examine feminist approaches to traditional research methodologies. The objective of this course is to examine feminist critiques of traditional research. The course will examine the animated and contentious debates among feminist scholars about what constitutes a feminist method. Although there is no single feminist method, this diverse academic community is searching for techniques consistent with their convictions as feminists. For this reason, the course will distinguish between methods, as tools for research, and methodology, as theory about the research process. The course reviews methods such as ethnography, interviewing, oral history, discourse analysis, visual analysis, and mixed method approaches. Cross Listings : GEOG 508 will be added as a cross-listed course.

Cross-listed with: WMNST 508

GEOG 510: Seminar in Physical Geography

3 Credits/Maximum of 18

Analysis of current literature in physical geography focusing on theoretical and methodological debates. GEOG 510 Seminar in Physical Geography (3 per semester/maximum of 18) This seminar explores current issues in physical geography. The focus for each offering of this advanced seminar is on a specific theme of current importance. Recent developments and ongoing research issues within that topic are explored in-depth. Topic examples include, but are not limited to: synoptic climatology and climate dynamics, the cryosphere, remote sensing, ecological biogeography and ecosystem dynamics, landscape and restoration ecology, wetlands ecology and management, and coastal and inland hazards.

Prerequisite: GEOG 454 , GEOG 455

GEOG 520: Seminar in Human Geography

3 Credits/Maximum of 18

Analysis of current literature in human geography focusing on theoretical and methodological debates.

GEOG 530: Human-Environment Seminar

3 Credits/Maximum of 18

Theory and method in human-environment interaction subfields; may be re-taken when topics vary; readings, discussions, research.

GEOG 550: Wetlands Ecology and Management

3 Credits

Recommended Preparations: One course in ecological or hydrological sciences. This course explores the diversity, complexity, ecological functions, conservation, and cultural values of freshwater and coastal wetlands through interdisciplinary discussions, readings, projects, and field trips. Learning Outcomes: Students successfully completing this course will gain an understanding about the ecology, management, and conservation of freshwater and coastal wetlands. They will be able to classify different wetland types using multiple methods, understand the breadth of wetland functions, and become familiar with laws, regulations, and approaches to conserve wetlands.

GEOG 560: Seminar in Geographic Information Science

3 Credits/Maximum of 18

Geographic information science problems/theory, e.g. GIS, cartography, remote sensing, spatial analysis, modeling.

GEOG 565: Selected Topics in Geographic Information Science

3 Credits

Examination of geographic information science topics: GIS, cartography, remote sensing, spatial analysis, modeling, spatial cognition, geospatial semantics, geovisualization.

GEOG 570: Capstone in Spatial Data Science

3 Credits

This course constitutes a culminating experience in the MS in Spatial Data Science (SDS). The course includes a semester project that demonstrates an SDS student's ability to apply advanced knowledge and skills related to applying spatial data science principles in a way that makes a substantial contribution to research in Spatial Data Science. Students in this class work individually to design, implement, and report on a project based on the application of spatial data science knowledge and skillsets gained through the SDS curriculum. Students will also collaborate with each other to iteratively develop and refine project topics, methods, and solutions. Students are oriented at the beginning of the course with modules reviewing research methods, public presentation strategies, and scholarly communication skills. Students commence their research immediately at the beginning of the semester and meet weekly milestones through the balance of the semester, engaging in peer review to refine their work in addition to receiving guidance from their instructor.

Concurrent: All degree and option requirements must be met prior to taking this course or be met concurrently in the same semester this course is taken.

GEOG 571: Intelligence Analysis, Cultural Geography, and Homeland Security

3 Credits

The main objective of this course is to enable students to develop the research and methodological skills required to effectively analyze current geospatial realities using the prism of cultural geography, and to create a rational predictive synthesis (intelligence summary) about potential human threats to civil security. The world around us comprises a variety of cultural and subcultural groups whose actions, ideologies, and existences may have implications for civil, national, and human security - either as communities that are underserved or marginalized, as groups that are targets of state or substate violence, or as groups that threaten the security of the state or international relations. While traditional, anthropology-oriented approaches to intelligence acknowledge these groups, they typically ignore the critical significance of geography to cultures and subcultures. This course is designed to engage students in theories and methods of cultural geography and to explore its relationship to security. Students will explore cultural geography as both a discipline and a methodological approach and situate research in cultural geography through case studies in homeland security and geospatial intelligence.

GEOG 580: GEOVISUAL ANALYTICS

3 Credits

Traces of geographic information reflected in digital data continuously increase in volume, variety, velocity, and variability. New geographic data sources, together with advancements in high-performance computing, present opportunities to dissect complex real-world problems in unprecedented ways. Human cognitive capability, however, remains constant, thus limiting our ability to extract value and insight from this data deluge. Geovisual analytics is the emerging science of analytical reasoning supported by interactive geovisualization, computational methods, and user-centered design. Geovisual analytics constitutes an essential subdomain in the broader field of Spatial Data Science. This seminar investigates the role of geovisual analytics in facilitating the human sensemaking process through (a) a survey and synthesis of research challenges surrounding the design, use, and evaluation of geovisual analytics systems and (b) exercises to design geovisual analytics approaches to tackle complex problem contexts such as those found in crisis management, epidemiology, and transportation domains.

Recommended Preparations: GEOG 486

GEOG 581: Spatial Data Science Ethics

3 Credits

GEOG 581 is for students who are concerned about the ethical implications and social impacts of geospatial technologies and methods. It traces the roots of Spatial Data Science Ethics in moral philosophy, professional ethics frameworks, and critical studies in the geospatial field. Students analyze non-trivial ethical case studies in which right and wrong actions are not clear-cut. They compare and critique relevant legal and policy issues in the U.S. and abroad. In addition, they evaluate the organizational ethics of firms and agencies (including current or potential employers) that provide spatial data science products and services.

GEOG 583: Geospatial System Analysis and Design

3 Credits

Systematic approach to requirements acquisition, specification, design and implementation of geospatial information systems. GEOG 583

Prerequisite: GEOG 484**GEOG 585: Open Web Mapping**

3 Credits

Design, development, and implementation of web mapping applications using OGC standards and open source software. GEOG 585 Open Web Mapping (3)The geospatial industry has developed a culture of open standards and specifications by which both data and mapping tools can be made interoperable. Web Mapping requires the detailed application of a thorough theoretical understanding of these standards, as well as a working knowledge of how these standards are realized through recent information technology advances in web services and middleware. The course gives students the theoretical base from which they can go on to design, develop, and implement custom web mapping applications using open standards and open source software. On completion of the course, students will be able to build and deploy a complete web mapping solution including selecting the spatial data, the server and client software. Students will be able to determine which type of mapping server is required for their needs and to explain why choosing an open standard based solution is better than a proprietary solution. The course will cover a variety of open source software packages for web mapping and will provide pointers to commercial solutions where appropriate. Open Web Mapping is designed specifically for adult professionals. The course will be broken down into ten lessons. Each lesson will take one week to complete and requires a minimum of 8-12 hours of student activity each week, totaling approximately 120 hours of activity. Topics to be covered in each lesson include: Lesson 1 Open Web Mapping Framework International Methods Lesson 2 Web Map Servers (WMS) basics Understanding the structure of a WMS request Understanding the structure of a WMS response Lesson 3 Web Feature Server (WFS) basics Understanding the structure of a WFS request Understanding the structure of a WFS response Lesson 4 Introduction to XML XML and web mapping XML schemas Lesson 5 Styling maps with WMS and Styled Layer Description (SLD) Cascading Web Map Servers Lesson 6 Geographic Markup Language (GML) Application Schemas and Profiles Lesson 7 Advanced WFS Gazetteers Other specialist applications of WFS Lesson 8 Building a web mapping applications Deploying a WMS Deploying a WFS Lesson 9 Building a thin web mapping client Client/ Server techniques Web mapping libraries and customizing them Lesson 10 The future of web mapping

Prerequisite: GEOG 485**GEOG 586: Geographical Information Analysis**

3 Credits

Choosing and applying analytical methods for geospatial data, including point pattern analysis, interpolation, surface analysis, overlay analysis, and spatial autocorrelation. GEOG 586

Prerequisite: GEOG 485 or GEOG 486 or GEOG 487**GEOG 587: Conservation GIS**

3 Credits

Conservation GIS applies geospatial problem solving to ecological research and resource management issues to enhance conservation planning.

Prerequisite: GEOG 487**GEOG 588: Analytical Approaches in Spatial Data Science**

3 Credits

This course focuses on theoretical discussions in spatial data science as well as the application of a range of spatial data science methods and tools to solve real-world problems and model geographic phenomena. Students will read, discuss, and synthesize research articles and develop coding solutions for spatial data science tasks through a series of lab exercises. Discussions will provide a platform for students to address emerging research challenges and coding problems in a collaborative framework. Exercises in this course provide students an opportunity design, implement, and troubleshoot analytical workflows while creating reproducible code for future adaptation. Students will develop concepts presented in readings to compare spatial data science methods and to create a new approach for a semester project.

Recommended Preparation: General programming and statistical analysis skills are recommended as preparation for this course.

GEOG 589: Emerging Trends in Remote Sensing

3 Credits

Highlights emerging theoretical and methodological trends in high-performance remote sensing for geospatial analysis through discussion and laboratory experiences.

Prerequisite: GEOG 480, GEOG 883**GEOG 590: Colloquium**

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

GEOG 591: GIS for Health Analysis

3 Credits

Applications and theory in geographic information systems for analyzing the geographic dimensions of human health.

Prerequisite: GEOG 484**GEOG 594: **SPECIAL TOPICS****

1-3 Credits/Maximum of 3

GEOG 594A: Culminating Experiences in Geospatial Intelligence

1-3 Credits/Maximum of 3

Culminating experiences in current professional and ethical problems facing the geospatial intelligence professional.

Prerequisite: GEOG 882 , GEOG 883 , GEOG 884 , GEOG 885 , or equivalent courses

GEOG 594B: Geospatial Intelligence Capstone Experience

2 Credits

This course brings together the concepts from the geospatial intelligence program and reinforces the standards of professionalism applicable to geospatial intelligence analysis. The aim is to enhance the student's understanding of the role of geospatial intelligence, develop individual competencies, reinforce professional concepts, and improve geospatial analytical techniques and methods. Students explore and critically analyze a current topic of interest and apply geospatial technical tools, concepts, and theories learned in previous coursework. Students prepare and deliver a formal presentation of the results of their geospatial intelligence capstone research project.

Prerequisite: GEOG 594A

GEOG 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

GEOG 596D: Independent Study/Engaged Scholarship

4 Credits/Maximum of 999

A supervised off-campus, non-group instruction with a geospatial education focus. The instruction may include individual field experience, employment, or internship (paid or unpaid).

GEOG 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

GEOG 597A: ****SPECIAL TOPICS****

6.00 Credits

GEOG 597I: ****SPECIAL TOPICS****

3 Credits

GEOG 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

GEOG 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

GEOG 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Theoretical and practical aspects of undergraduate instruction in geography.

Prerequisite: concurrent status as graduate teaching assistant

GEOG 603: Foreign Academic Experience

1-12 Credits/Maximum of 12

Foreign study and/or research constituting progress toward the degree at a foreign university.

GEOG 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

GEOG 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

GEOG 850: Location Intelligence for Business

3 Credits

In business, the application of maps and mapping technology ranges from a long-standing presence (commercial real estate, retail, and logistics) to nascent analytical applications across different industries. The momentum for commercial applications that encompass GIS, geospatial intelligence (GEOINT) technologies, and geospatial intelligence analysis is growing. In businesses, geospatial attributes are being combined with enterprise-wide databases. GIS and GEOINT tools and methodologies can now be folded into the more mainstream information technology (IT) applications of business intelligence (BI) to formulate location intelligence (LI) applications, products, and services. This course explores and applies the key geospatial intelligence principles involved in site selection, market analysis, risk and crisis management, and logistics, providing opportunities for students to solve those problems with contemporary geospatial tools and datasets. This course provides a foundation for spatial thinking and analysis in commercial settings, and experience with contemporary mapping and analysis tools for professional applications of location intelligence.

Recommended Preparations: GEOG 482

GEOG 855: Spatial Data Analytics for Transportation

3 Credits

This course explores the spatial data science and technology associated with the transportation industry. This interdisciplinary field is often referred to as GIS-T. There is a natural synergy between GIS and transportation, which has resulted in a number of specialized techniques and a wide variety of GIS-T applications. To appreciate the value GIS brings to the transportation industry, students need to have some understanding of the business of transportation and the challenges and problems those in the industry face. Consequently, they will learn about a number of subdisciplines within transportation and examine how GIS has been applied to each. Students will also explore some of the key organizations in the transportation industry who use GIS and

learn firsthand from transportation professionals, representing a variety of specialized fields, about the role GIS plays for them. Throughout the course, students will study GIS concepts and techniques which are fundamental to transportation, such as transportation networks and linear referencing systems. In addition, they will have the opportunity to explore a number of GIS applications and tools related to transportation. Due to the overall breadth of the transportation industry, the course will focus primarily on the largest application areas: highway and mass transit. We will, however, examine other significant modes, including aviation, maritime, pedestrian, and bike transit. Furthermore, while much of the course content is oriented around the U.S. transportation industry, students will also look at GIS-T applications and trends in other parts of the world.

Recommended Preparations: GEOG 482

GEOG 858: Spatial Data Science for Emergency Management

3 Credits

Geospatial perspectives and technologies have a major role to play in planning for and responding to emergencies. As is true with other analytical paradigms, geospatial systems and technologies - from aerial mapping techniques to data acquisition - are changing rapidly. Emergency management is also changing quickly as the frequency and magnitude of crises and disasters are increasing, and more and more people and places are being impacted. GEOG 858 helps students develop proficiency in the theoretical, analytical, and technical perspectives required to support all stages of emergency (crisis or disaster) management activities with geospatial solutions, ranging from small-scale emergency management efforts to large-scale disasters and humanitarian crises. Topics covered in GEOG 858 will include advancements in geospatial data collection, geospatial data processing and analysis capabilities, unmanned aerial systems (UAS), geospatial artificial intelligence (geoAI), volunteered geographic information (VGI), geospatially-oriented social media, and others.

Recommended Preparations: GEOG 483

GEOG 861: The Earth is Round and Maps are Flat: Working with Spatial Reference Systems in GIS

3 Credits

The course explores three important topics related to georeferenced data: Datums, map projections, and grid systems. Accurate coordinates are the key to successful manipulation in a geographic information system (GIS). The course begins with a detailed look at datums and the role they play in mathematically describing the Earth's shape and size, defining exact Earth coordinates, and establishing the height of a point above mean sea level. Map projections are examined next. These formula-based entities are implemented as algorithms in GIS, remote sensing, and other kinds of mapping and spatial analysis software that systematically take Earth's coordinates and convert them to a planar environment. Grid systems conclude this course with a discussion of their utility when carrying out accurate measurement activities on maps. Collectively, this course provides the theoretical underpinnings and applied knowledge necessary to understand and effectively work with the wide range of available datums, map projections, and coordinate systems that are available today.

RECOMMENDED PREPARATIONS: GEOG 483

GEOG 862: GPS and GNSS for Geospatial Professionals

3 Credits

Cultivates a working knowledge of current and future capabilities of GPS and the emerging Global Navigation Satellite System. GEOG 862 GPS Modernization for Geospatial Professionals (1) Topic: The Global Positioning System (GPS) includes a constellation of earth-orbiting satellites that broadcast their locations in space and time, a network of ground control stations, and military and civilian receivers that calculate ground positions by trilaterating satellite positions. Geospatial professionals need to possess a working knowledge of current and future GPS capabilities because GPS positioning is so prevalent in geographic information systems (GIS) applications in government, industry, and academia. GPS has always been a dual use system, military and civilian. From the beginning, GPS signals have been available with no direct user fees. GPS is used now in all of transportation-aviation, maritime, railroad, highway and mass transit. Satellite positioning also plays critical roles in telecommunications, land surveying, law enforcement, emergency response, precision agriculture, mining, finance, and scientific research. It controls computer networks, air traffic, power grids, and so on. As the scope of GPS has expanded, the system continues to evolve. Course Objectives: GEOG 862 provides students with an opportunity to develop an in-depth understanding of the Global Positioning System that exceeds the basic awareness that is cultivated in prerequisite courses. For example, while it is useful to know that a minimum of 24 GPS satellites ensure 24-hour worldwide GPS coverage, it is equally important to understand why there are more than the minimum on orbit. Students in GEOG 862 learn that redundancy is necessary in a system upon which much of the U.S. economy now depends. Society's reliance on satellite positioning mandates GPS modernization. Student Activities: The course consists of four weekly lessons. Each lesson will require a minimum of 8-12 hours of activity. Lessons will include weekly lectures (via synchronous Web conference and/or streaming video), threaded discussion, readings, two quizzes and two writing assignments about concepts and tools in GPS Modernization. These assignments are designed to help students progress towards successfully completing the objectives for this course. * Class Participation: Individual participation via online discussion. Students will be encouraged to post and respond to questions and comments in online discussions forums. *Quizzes: There will be a mid-course quiz at the end of Week 2 and a final quiz at the end of Week 4 to test the students' comprehension of class materials and other reading as required. *Papers: There are two writing assignments in this course. The first falls after Week 1 and asks students to prepare a 1200 word paper on one topic covered in "Basic GPS," The first lesson. The second falls after Week 3 and asks the students to prepare a 1200 word paper on one topic covered in either Week 2 or Week 3.

GEOG 863: Web Application Development for the Geospatial Professional

3 Credits

The Internet has greatly extended the reach of GIS beyond the desktop. Geospatial technology vendors and the open-source community have devised web service protocols and web mapping application programming interfaces (APIs) so that third-party developers can create their own applications for use on web-enabled devices. These applications serve a wide array of purposes, including place and way finding, data dissemination, and data collection. For example, tabular crime data published on a city's website can be combined with base data layers such as municipal boundaries and roads to produce a map that is valuable for both the city's police department and its citizens. This course focuses on how geospatial professionals can create such

applications using industry-relevant geospatial APIs. Students will build applications using current and emerging web technologies. Topics covered will include the implementation of 2D maps and 3D scenes, understanding API documentation, layer discovery and visualization, user interface development, data querying, and geoprocessing.

Prerequisite: GEOG 485

GEOG 864: Professionalism and Ethics in Geographic Information Science and Technology

3 Credits

Professional practice and ethics in the Geographic Information Science and Technology (GIS&T, a.k.a. geospatial) field requires being both competent in one's work and reflective about its legal and ethical implications. Certified GIS&T professionals are required to affirm their commitment to legal and ethical practice. Fulfilling such commitments requires the ability to recognize and analyze legal and ethical problems and to act with integrity. In this course students investigate the nature of professions generally and the characteristics of the professions that occupy the GIS&T field in particular. Students gain awareness of pertinent legal and ethical issues and hone their moral reasoning skills through methodical analyses of case studies in relation to the GIS Code of Ethics and Rules of Conduct. Assignments include readings, case study analyses, interactive discussions, practitioner interviews and preparation of original case studies.

GEOG 865: Cloud and Server GIS

3 Credits

Theory and practical applications of using cloud computing and server resources to solve geospatial problems. GEOG 865 Cloud and Server GIS (3) This course teaches students to use cloud and server GIS resources to solve problems for which geospatial data is an integral element. Students will evaluate and implement systems using three cloud service models; infrastructure services, platform services, and software services. The course involves both lab exercises and critical reading and writing for infrastructure, platform, and software service models. This course presents common methodologies for setting up cloud services for creating maps, to customize cloud services for managing spatial data, and to invoke cloud services for processing spatial data. This course challenges students to apply critical thinking and technical skills to evaluate and develop successful cloud GIS projects. Written assignments focus on helping students improve their ability to explain and execute cloud GIS projects. A semester-long project involves creating a working cloud GIS project, including public presentation of results.

Prerequisite: GEOG 484

GEOG 868: Spatial Database Management for the Geospatial Professional

3 Credits

This course helps students learn how to create, maintain, and retrieve data from a spatially-enabled database. Access to accurate data is the cornerstone on which all successful professional geospatial organizations are built. The data stewards who maintain an organization's information systems therefore have a crucial role to play. The course begins by introducing relational database theories and structures that are common in both geographic and non-geographic contexts (e.g., Structured Query Language and database design). It then focuses on the special considerations involved in the management of a

spatial database by demonstrating two commonly utilized professional approaches

Prerequisite: GEOG 484

GEOG 870: Capstone in Geographic Information Systems

3 Credits

This capstone course develops Master in Geographic Information Systems students' research and technical competencies to meet degree requirements and to serve their future career goals. Students completing this course will synthesize the learning they have completed in their M.G.I.S. coursework and develop an applied spatial analysis project that utilizes contemporary methods, technologies, and data sources to solve a problem in their field. The course makes use of discussions, presentations, directed independent research, collaborative critiques, and an individual scholarly paper.

Recommended Preparation: All degree and option requirements must be met prior to taking this course or be met concurrently in the same semester this course is

GEOG 871: Geospatial Technology Project Management

3 Credits

In this course, students take a critical look at geospatial project management. Project management is a broad discipline that encompasses both technical methods such as system design and analysis, and interpersonal factors that affect professional relationships. Project management is also a discipline that has matured outside of, but can be incorporated into, geospatial technology.

Prerequisite: GEOG 583

GEOG 882: Geographic Foundations of Geospatial Intelligence

3 Credits

Orientation to the geographic foundations of geospatial intelligence and its applications in national security, international relief work, and disaster management. GEOG 882 Geographic Foundations of Geospatial Intelligence (3) Topic: Geospatial intelligence (GEOINT) leverages geographic information science and technology (including cartography, geographic information systems, remote sensing, and global positioning systems) with intelligence tradecraft to develop intelligence products that support national security, disaster response, and international relief efforts. Course Objectives: GEOG 882 is designed to challenge current and aspiring GEOINT professionals to be more than technicians. Students who successfully complete GEOG 882 will appreciate that while geospatial technologies are useful in revealing what, who, and where, and to some extent how events are taking place, they are less useful in explaining why events occur, or what response is most appropriate. Students will learn that the political, cultural, historical, and economic perspectives of human geography are needed to put GEOINT analyses in context. The course will also challenge students to approach analyses critically, to consider alternative viewpoints and explanations, and to question their own assumptions. Student Activities: The course consists of 12 lessons that will span either the 15-week semester or the combined 12-week summer sessions. Each lesson will require approximately 10 hours of student activity. Student activity will include viewing and responding to recorded instructor lectures (delivered by digital video and audio), readings from textbooks or selected library resources, five quizzes on readings, four asynchronous online discussion forums,

three reflection papers, and a collaborative role-playing simulation that provides a capstone experience.

GEOG 883: Remote Sensing Image Analysis and Applications

3 Credits

GEOG 883 focuses on the use of medium and high resolution remotely-sensed imagery and elevation data in geospatial applications. This course assumes that students have prior knowledge in the basics of remote sensing, mapping, and GIS, and that they have prior experience with commonly used geospatial software. In GEOG 883, students will develop mastery of the tools and techniques used to display, process, and analyze remotely sensed data. Upon completion of GEOG 883 students will be able to develop analytical workflows to derive products and extract information from remotely sensed data for a broad range of applications using both pixel-based and object-based approaches. GEOG 883 Remote Sensing for the Geospatial Intelligence Professional (3)Topic: Geospatial intelligence (GEOINT) leverages geographic information science and technology (including cartography, geographic information systems, remote sensing, and global positioning systems) with intelligence tradecraft to develop intelligence products that support national security, disaster response, and international relief efforts. Course Objectives: GEOG 883 cultivates students' knowledge of the capabilities and limitations of digital remote sensing instruments, processing systems, and derived data products. It helps students master basic skills needed to leverage these data sources and information products in the context of geospatial intelligence tradecraft. Student Activities: The course consists of eight lessons and one capstone group project that will span either the 15-week semester or the combined 12-week summer sessions. Each lesson will require approximately 10 hours of student activity. Student activities will include reading lesson text, online quizzes, and discussions about the ways in which remote sensing sciences is applied to geospatial intelligence analysis.

Prerequisite: GEOG 480

GEOG 884: Spatial Data Science and Intelligence Analysis

3 Credits

This course engages students with the theory and practice of integrating spatial data science with geospatial intelligence tradecraft in a professional context. The world around us has a variety of competitors whose actions impact civil, national, and international security. Spatial data science can help us to understand and predict a competitor's behavior when integrated with geospatial intelligence tradecraft. Students will apply and critique analytical methods and intelligence techniques through case study exercises. Course lessons engage the technical methods found in spatial data science and geospatial intelligence techniques used to create a rational synthesis, known as an intelligence summary, about a given geospatial intelligence situation.

GEOG 885: Advanced Analytic Methods in Geospatial Intelligence

3 Credits

Prepares current and aspiring geospatial intelligence professionals to apply and interpret results of non-quantitative analysis and modeling techniques.

Prerequisite: GEOG 882

GEOG 892: Geospatial Applications of Unmanned Aerial Systems

3 Credits

Introduces theory and methods for operating an unmanned aerial system for geospatial data acquisition and analysis.

Prerequisite: GEOG 480

GEOG 897: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject.

Geosciences (GEOSC)

GEOSC 500: Issues in Geosciences

3 Credits

Introduction of first year graduate students to issues in geosciences. GEOSC 500

Prerequisite: admission to the Geosciences Graduate Program

GEOSC 501: Words to Live by: Professional Communication in the Geosciences

3 Credits

This course develops writing skills for graduate students seeking careers in the geosciences. It emphasizes expression of research questions, methods, and findings with engaging text, compelling arguments and narratives, and impactful figures. The course covers scientific editing and publishing, professional correspondence, and broader science communication using news and social media

Prerequisites: GEOSC 500 Recommended Preparations: The student should be engaged in graduate-level research and preparing for a professional career in the geosciences.

GEOSC 502: Evolution of the Biosphere

3 Credits

The geologic history of the co-evolution of life and the surface environment is examined from an Earth systems perspective. The course will examine significant events in Earth history through a combination of lectures, discussions, papers, and presentations. In particular, the class will use selected events in Earth history to highlight the various and varied geochemical and molecular records or proxies related to life on Earth. Assessment will include an examination, required discussions, research proposals, and peer evaluation of research proposals.

Recommended Preparation: Undergraduate-level coursework in biology and geology or consent of instructor.

GEOSC 508: Mechanics of Earthquakes and Faulting

3 Credits

An in-depth treatment of fundamental concepts in brittle faulting and earthquake mechanics with emphasis on physical processes. GEOSC 508

Prerequisite: GEOSC465 , GEOSC489 , MATH 251

GEOSC 511B: Transmission Electron Microscopy

1 Credits

Principles and practice of transmission electron microscope operation. Students undertake individual projects.

Cross-listed with: MATSE 511B

GEOSC 514: Data Inversion in the Earth Sciences

3 Credits

This course focuses on how one finds theoretical parameters to explain observed data using discrete inverse theory.

Prerequisite: MATH 220

GEOSC 518A: Isotope Geochemistry Fundamentals

2 Credits

This course covers the fundamental knowledge and quantitative approaches used in the application of isotopes and their relative abundances within the natural and applied sciences. Students will gain understanding of the theory and guiding principles of isotope systems, including isotope fractionation, radioactive decay, mass balance, isotope notation, and quantitative treatment of isotopic data. The course will cover methods of isotope analyses and the quantitative treatment of isotope data. After successfully completing the course, students will be able to apply theory and methods in isotope systems to diverse disciplines spanning Earth, material, biological, and environmental sciences.

GEOSC 518B: Isotope Biogeochemistry

2 Credits

This course explores knowledge and quantitative approaches used in the application of isotopes within the biogeochemical sciences. Students will gain advanced understanding of isotopic data relevant to the cycling of life-sustaining elements and substrates, including carbon assimilation, metabolic processes and products, and energy metabolism. The course will focus on isotopes of the major elements (C,H,N,O,S) and include examples involving minor elements or metals relevant to biogeochemistry. Each course module will cover a core concept (or concepts) that provides a theoretical framework for understanding isotopic distributions in a certain type of system, and then apply this concept to a range of real-world topics. After successfully completing this course, students will be able to apply methods in isotope biogeochemical systems in fields relevant to the biological, ecological, environmental, soil, and earth sciences.

GEOSC 518C: Isotopes in Oceans and Climate

2 Credits

Students in this course will explore the isotopes that build the major molecules involved in Earth's oceans and atmospheres. In particular, the course investigates how isotopes within Earth materials can record and reconstruct: climate from an anthropogenic and deep-time perspective, hydroclimate, climate states in Earth's past, atmospheric chemistry, ocean chemistry, and the carbon cycle.

GEOSC 518D: Isotopic Analysis in the Geosciences

2 Credits

This course covers the principles and practice of analyzing the isotopic composition of natural geological and biological materials. In particular, the course investigates the physical and chemical principles underlying: the conversion of matter into atomic and molecular ions, the separation of charged particles by mass, and the detection of ion beam intensities for the purpose of precise, accurate, reproducible determination of isotopic ratios in geoscientific applications. The course delves into the principles behind, and practical considerations of, the equipment that enables contemporary mass analysis techniques, such as power supplies, vacuum systems and monitoring, signal detecting and processing, data handling, and standardization. Students will gain advanced understanding of how isotopic ratios are measured, an appreciation of how analytical developments guide (and have guided) research questions in isotope geochemistry, along with practical training in the operation and maintenance of modern mass spectrometers. Through analysis of the scope and limitations of existing techniques and instrumentation, students will be empowered to incorporate isotopic analysis into their research and design methods to support new research directions.

Prerequisites: GEOSC 518A Recommended Preparations: Two semesters of college-level physics, 1-2 semesters of general chemistry, and 1 semester of analytical/instrumental chemistry. Previous exposure to the concepts of aqueous solvation, ion chromatograph

GEOSC 518E: Isotope Geochemistry: Solid Earth

2 Credits

This course covers specific tools using isotope geochemistry to understand the Solid Earth. Students will build on a fundamental knowledge of isotope geochemistry and learn how to apply that fundamental knowledge to specific problems in crustal evolution, geochronology, and high-temperature planetary processes. Through in-class discussions and weekly problem sets, students will gain awareness and practical experience with both solid Earth science questions, and the utility of isotope geochemistry for answering such questions. Students will leave this course with an understanding of which isotope systems can be used to answer particular scientific questions, and importantly, which cannot.

GEOSC 519: Mineral Equilibria

3 Credits

A thermodynamic treatment of minerals and their reactions under geochemically important conditions of temperature and pressure.

Prerequisite: CHEM 450

GEOSC 521: Thermal State of the Earth

2-3 Credits/Maximum of 3

Analytical and numerical solutions to earth-related heat conduction and convection problems; geothermal energy; earth's heat flow and temperature.

GEOSC 522: Geochemistry of Aqueous Systems

2-3 Credits/Maximum of 3

Ionic and molecular equilibria related to stabilities and solubilities of minerals, with applications to ground water, sea water, and hydrothermal fluids.

Prerequisite: CHEM 450 , CHEM 452**GEOSC 523: Sedimentary Geochemistry**

2 Credits

Kinetics and thermodynamics of low-temperature processes in sediments. Applications to weathering processes, natural waters, deposition of sediments, and diagenesis.

GEOSC 533: Principles of Geochemistry

3 Credits

A comprehensive treatment of the principles of geochemistry applied to a wide variety of geologic settings and scales.

Prerequisite: CHEM 450**GEOSC 536: Topics in Biogeochemistry**

2 Credits/Maximum of 999

This seminar addresses chemical interactions between the biosphere and the physical environment over Earth's history and as impacted by humans. This course will provide a broad survey of biogeochemical principles, and offer a community-building experience for students with biogeochemical interests from diverse departments. Students will complete the course with a synthetic knowledge of the key topics in the field of biogeochemistry. Each week we will focus on a topic within the broad field of biogeochemistry such as: origins of the elements, reactions in the atmosphere, soil development, the distribution of redox reactions and microbial metabolic pathways, and the global cycles of carbon, water, nitrogen, phosphorus, sulfur, mercury, and perhaps other elements. For each topic, we will focus on the questions: What is known or can be observed? How is this information used to understand biogeochemical phenomena and process? How are these processes scaled over time and space? What are emerging and important questions in the subspecialties of biogeochemistry?

Cross-listed with: CE 536, SOILS 536

GEOSC 542: Quantitative Methods in Hydrogeology

1-4 Credits/Maximum of 4

Investigation of groundwater systems and resources, emphasizing both the practical use and limitations of modeling techniques.

Prerequisite: GEOSC452**GEOSC 548: Surface Processes**

3 Credits

Principles, application, and interpretation of Quaternary geochronology, surface process studies, and landscape evolution.

Prerequisite: GEOSC340**GEOSC 555: Advanced Structure and Petrofabrics**

1-3 Credits/Maximum of 3

Macroscopic and mesoscopic recognition, measurement, and interpretation of small-scale rock structures and mineral orientation patterns in deformed rocks.

GEOSC 558: Multi-channel Seismic Processing and Interpretation

4 Credits

This course covers the basics of seismic energy propagation, modern 2- and 3-D multi-channel seismic data acquisition methods, and data processing.

Prerequisite: GEOSC454**GEOSC 559: Seismology II**

3 Credits

Rigorously covers the methods of computing wave fields for point and distributed seismic sources in vertically inhomogeneous elastic media.

Prerequisite: E MCH524A , E MCH524B , or MATH 405 , MATH 406**GEOSC 560: Kinetics of Geological Processes**

3 Credits

General development of the kinetic theory of crystal growth, diffusion, irreversible thermodynamics, and heterogeneous reactions needed for geosciences and related fields with applications to current problems.

Prerequisite: CHEM 450 , GEOSC519**GEOSC 561: Mathematical Modeling in the Geosciences**

4 Credits

The process of transforming a conceptual geoscience model into a numerical model is presented; students create and solve numerical models.

Prerequisite: undergraduate-level calculus and geology coursework is required; experience in computer programming and coursework in differential equations is recommended; or consent of instructor**GEOSC 565: Tectonic Geomorphology**

3 Credits

Tectonic geomorphology examines interactions between tectonic and surface processes, paleoseismology, geodesy, structure, active deformation, and landform evolution.

Prerequisite: GEOSC340 , GEOSC465**GEOSC 572: Field Stratigraphy**

1-2 Credits/Maximum of 2

This course introduces students to field techniques used by stratigraphers, with the capstone experience being a field trip during May.

Prerequisite: GEOSC439 , GEOSC472A , GEOSC472B , GEOSC479

GEOSC 585: Sedimentary Geology

3 Credits

An integrated approach to the study of modern and ancient sedimentary environments and their deposits.

Prerequisite: undergraduate coursework in sedimentology or consent of instructor

GEOSC 587: Preparing for an Academic Career in the Geosciences

3 Credits

The course focuses on successful strategies for the academic job market and for launching an academic career. GEOSC 587 Preparing for an Academic Career in the Geosciences (3) This seminar is designed for advanced doctoral students who are ready to launch their own search for an academic position. We will explore important elements of the transition into an academic career, including the application and interview process and strategies to establish teaching and research programs. During the semester students will: (a) learn about roles and responsibilities of faculty members in different educational settings (e.g., community colleges, four-year colleges, universities); (b) Design a teaching and research plan suitable for the next career stage and write teaching and research statements to summarize these plans; (c) Learn strategies for documenting their strengths and accomplishments in teaching and research; (d) Learn "the inside scope" about job searches including how to navigate the application process, interviews, and negotiation; (e) Learn how to give an effective job talk; (f) Discuss strategies for balancing the many demands and expectations they will face in an academic career. Finally, students will develop a self-inventory of preferred options for the next career stage and a personal action plan.

Prerequisite: Students must have passed their comprehensive exam and be within a year from receiving their Ph.D. degree.

GEOSC 589: Critical Zone Science Seminar

1-3 Credits/Maximum of 3

This course will explore the foundations, discoveries, and applications linked to the Critical Zone concept through primary literature, class discussions, and original student projects. We will start by spending one week each on the four foundational science domains that are woven together to make Critical Zone science: hydrology, geoscience, soil science, and ecology. Then we will spend several weeks highlighting key discoveries that arise from the interdisciplinary Critical Zone perspective. The end of the class explores whether the Critical Zone science perspective might have useful applications for land and water management. Throughout the class, students take a co-leadership role with the instructors in terms of selecting readings, lecturing, and designing active learning allied with key concepts.

Cross-listed with: CE 589, SOILS 589

GEOSC 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

GEOSC 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

GEOSC 597: Special Topics

1-9 Credits/Maximum of 999

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

GEOSC 597C: **SPECIAL TOPICS**

3 Credits

GEOSC 597D: **SPECIAL TOPICS**

2 Credits

GEOSC 597E: **SPECIAL TOPICS**

1 Credits

GEOSC 597F: **SPECIAL TOPICS**

1 Credits

GEOSC 597I: **SPECIAL TOPICS**

2 Credits

GEOSC 598: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

GEOSC 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

GEOSC 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

GEOSC 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Supervised experience in teaching geosciences courses.

GEOSC 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

GEOSC 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

German (GER)

GER 510: Literary Theory: An Introduction

3 Credits

Introduction to the major theoretical approaches to the contemporary study of culture (literature, film, art and politics). GER 510 Literary Theory: An Introduction (3) This seminar will introduce students to contemporary literary and cultural theory in an effort to provide them with the methodological tools they need to undertake cutting-edge literary and cultural analysis themselves. German Studies in the U.S. has at least two defining characteristics. First, though, at least for those of us in German Departments, its emphasis is mainly on culture, it is genuinely interdisciplinary, attempting to explore how cultural products and practices (defined as extending far beyond the traditional canon of German literature) are constituted by and help to constitute history and politics. And, secondly, it advances its interdisciplinary analyses by drawing increasingly on new methodologies elaborated by Anglo-American and foreign cultural theorists. Among the theoretical approaches we may focus on will be formalism and structuralism, psychoanalysis, Marxism, cultural studies, feminism, gender studies, and queer theory, and post-colonial theory. These new theories have profoundly transformed disciplines such as Anglo-American literary studies, comparative literature, women's studies, history, and anthropology, since the Seventies. In this course we shall find out if/how such theories could transform German Studies, too. The course is reading-intensive and students are expected to invest most of their time in reading and preparing for class discussions. Regular attendance and informed participation in class discussion will be required. This involves reading all assigned articles on a regular basis (20%); oral presentation of one weekly section (30%); second oral presentation that includes a sample analysis of the assigned texts (20%); and one 12-15 page paper due at the end of the semester (30%). German 510 will be the second unit in a three-course package intended to provide beginning graduate students with a set of correlated introductory courses. German 510 is the only wide-ranging course in theory offered by the Department for incoming students. This course will be offered once a year with 5 to 10 students (1-5 max) per offering.

GER 511: The Teaching of College German

3 Credits

Theory, methods, techniques, materials, bibliography contributions of linguistics and psychology to language learning; methods of teaching post-secondary German. GER 511 The Teaching of College German (3) German 511 introduces students to the theory and methods of teaching German at the college level. It deals not only with techniques, materials, and bibliography of the field but also evaluates the contributions of linguistics and psychology to college-level language pedagogy. German 511 familiarizes students with current theories of foreign language education as they relate to post-secondary language acquisition. This course further includes the practical aspects of college-level teaching with special reference to problems related specifically to the teaching and learning of German. Evaluation procedures include examinations, research papers, and the preparation of sample teaching materials.

German 511 is a required course for all German graduate students both at the M.A. and Ph.D. level. It is offered every year.

GER 513: German Phonetics and Phonology

3 Credits

This course examines German speech sounds and their organization into a linguistic system. GER 513 German Phonetics and Phonology (3) This course provides an overview of the major subfields of phonology as they apply to the German language. No prior knowledge of linguistics or phonology is assumed. Topics discussed include articulatory phonetics, the phoneme, distinctive features, and common phonological processes in German such as final devoicing, prosody, prosodic morphology and dialectal variation. The class will practice phonetic transcription of German and English. We will discuss common phonetic and phonological difficulties presented by German for native speakers of English. In addition to practical applications of phonetics, the class will investigate theoretical concepts such as the phoneme, distinctive features, lexical stress, the syllable and the prosodic foot. Reading assignments include scholarly articles employing different theoretical frameworks and excerpts from seminal works in the field. Frameworks to be discussed include derivational approaches and Optimality Theory. The class will also examine dialectal variation with a particular emphasis on differences between Low, Middle and Upper German dialects. Each student will make a presentation investigating the phonological system of a German dialect. Evaluation is based on problems, class presentations and a final research paper.

GER 514: German Syntax

3 Credits

This course provides an overview of morphosyntactic processes in German. GER 514 German Syntax (3) This course provides an overview of the major components of morphology and syntax as they apply to the German language. No prior knowledge of linguistics or morphosyntax is assumed. Topics discussed include the basic syntactic constituents in German, the verbal bracket and movement rules, German argument structure, the tense/mood/aspect system for German verbs, the connection between pragmatics and word order in German, and dialectal variation as it relates to German syntax. Emphasis will also be placed on how these different areas of German syntax are related to descriptive grammar rules as presented in many German language classes. Reading assignments include scholarly articles employing different theoretical frameworks, including minimalism, and excerpts from seminal works in the field. Evaluation is based on problem sets, two take-home exams and a research paper.

GER 524: Remapping the Holocaust

3 Credits

In most university courses, the Holocaust is taught chronologically, beginning with the rise of the Nazi Party and then following the German armies through Europe and into the Soviet Union. The retreat of those same forces beginning in 1943 parallels the concentration and professionalization of the killing process which then begins to break down as the war comes to an end. This narrative is not incorrect, and certainly makes sense for introductory courses. Yet it also mirrors the perpetrators' perspective. A graduate course allows us to explore different perspectives on the war and genocide and how these affect both the periodization and the geography of the Holocaust. In this course we will examine a number of divergent historiographic trends regarding the

origins, enactment, end, and aftermath of the Holocaust. These will help students to think more broadly about the place of the Holocaust in world history and how new theories, methods and questions can be applied to other historical events.

Cross-listed with: JST 524

GER 530: The Frankfurt School & the Politics of Visual Aesthetics

3 Credits/Maximum of 999

The course examines the Frankfurt School's critical theories regarding visual strategies for representing and challenging urban consumer culture. The course will examine critical theories by members of the Frankfurt School regarding visual strategies for representing and challenging urban consumer culture. The course will center on German Marxist theories about how the rise of urban mass culture at the beginning of the twentieth century produced Modernist forms of visual representation. The course will examine how the spread of fashion-driven behavior had dramatic implications for aesthetic theory, film, architecture, and literature. The course will provide a survey of the most important works in the German critical tradition and the major thinkers associated with the Frankfurt School. These include Georg Simmel, Georg Lukacs, Siegfried Kracauer, Walter Benjamin, Theodor Adorno, and Jürgen Habermas, among others. Students will learn how these modern theories relate to the German Idealist tradition, particularly Kant, Hegel, and Nietzsche, as well as the history of German Marxism. Topics include the psychology of the metropolitan individual, the commodification of culture, money, and interpersonal relationships, the architecture of shopping, visual advertising through posters and photography, and cinema as a means of understanding social relations, as well as the role of visual media in public debate. The course will consider how modernist architecture, particularly from the Bauhaus school, redefined urban spaces and introduced new functionalist designs. The course will examine how Frankfurt School thinkers responded to the provocative design proposals presented by modernist architects. Students will examine specific modernist designs for consumer products to examine the relationship between the appearance of a commodity and its use, in order to understand how appearance and function are interdependent within modernism. In broad terms, class discussions will focus on such questions as: How does the relationship between the visual image and society change under industrial capitalism? What political functions do visual images have in consumer culture? What visual mechanisms does the "culture industry" deploy to organize public consciousness? What critical responses are available to visual artists within a mass-market economy? The course will provide students an historical understanding of early twentieth-century German consumer culture and its visual representation, while also offering them critical intellectual tools to understand the social and economic implications of visual images within consumer culture. The course will be taught in English with readings in both languages.

GER 532: Holocaust and Visual Culture

3 Credits

This course studies how art, literature, film, and other media can provide a perspective on one of the most horrific events in human history, the Holocaust: the genocidal murder of more than six million men, women, and children (mostly Jewish) under the Nazi regime during World War II. The course examines the theoretical questions involved in any attempt to capture what appears to be beyond comprehension in terms of moral outrage and the sheer scale, inhumanity, and bureaucratic efficiency of the violence perpetrated by the Nazis. This course examines formal

approaches of depicting the Holocaust in literature and film, as well as photography, museum installations, and memorials. Topics to be discussed include include memorialization (Holocaust museums and memorials), mass murder of the disabled, national guilt, survivor's guilt, stigmatization, and the ethics of historical representation. The course will analyze cinematic strategies for representing the unrepresentable, dark humor about the Holocaust, the persistence of the past, Nazi propaganda, Holocaust photography, trauma theories, graphic novels, the Nuremberg trials, survivor memoirs, representations of the Nuremberg Code and the International Bill of Norms, and possibilities for art after Auschwitz.

Cross-listed with: JST 532, VSTUD 532

GER 534: History of German Film and Photography

3 Credits

This course will examine the history, theory, and practice of German photographic and moving picture technology from its origins to the digital age. The course will be structured around important innovations in visual technology, including: 1) the pre-history and invention of photography, 2) pre-cinematic moving pictures (Anschütz), 3) the invention of cinema (Skladanowsky Bros.), 4) sound and color innovations, 5) video, digital, and installation work. The aim of the course is to provide an historical overview of visual culture in which the radical shifts inaugurated by new technologies are examined in terms of their aesthetic, philosophical, and political impact. In the German context these shifts have been examined by important theoreticians of visual culture (most notably Arnheim, Balász, Benjamin, Kracauer, and Flusser) whose work has changed the way we think about our relation to images. Practitioners in the German sphere have been no less influential: from Ottomar Anschütz's pre-cinematic experiments with moving pictures to the very first public demonstration of cinematic technology (the Skladanowsky's bioscope, one month before the Lumières' first show) to the avant-garde animation of the Weimar period; from the narrative and design innovations of the Expressionist filmmakers to the rich and varied independent films of the New German Cinema to the radical documentarians of the past decade. By providing students with an understanding of German innovations in and responses to new technologies this course will ground readings of particular works historically. In broad terms, class discussion will consider questions such as: What is the aesthetic status of the photographic image in relation to painting? What is the ontological status of the photograph as a chemical imprint of light? How do these new technologies lend themselves to political action? How is the spectator differently constructed by these technologies? In what way is the still image integral to the moving image-and what implications do these have for our perception of time? What is the new role of the image in mass, consumer culture (subversive or complicit)? How do the formal and technical affordances of the film-based image contribute to the construction of national, race, and gender identities, to spectator desires, and to new aesthetic categories? Readings will be available in German and in English. Class discussion will be in English.

GER 537: Photography, Race, Genocide

3 Credits

This course explores the role of photography in the context of the racialized politics of genocides and their aftermaths. The course aims to critically examine photographic evidence of genocidal violence, revealing the long shadow of modern genocides from colonialism, to the Holocaust, the Armenian, Cambodian, Rwandan genocides, to the present. At the intersection of modern constructs of race as they culminate in genocidal violence, the course investigates the political and

ethical potential of photography. Topics include: definitions of genocide; modern genocides; colonialism and the concept of race; the origins of photography; photography in literature and film; the civil contract of photography; the ethics of testimonies; atomic light; commemoration and the aftermath of genocides; race after technology.

Cross-listed with: JST 537, VSTUD 537

GER 538: German Expansionism, War & Violence: From the Seven Years' War to the War in Afghanistan

3 Credits

The course explores the various intersections between domestic politics and sociocultural developments and policies of martial brinkmanship, spatial expansion, and policies of ethnic cleansing and genocide. The course traces change over time with respect to ideas and practices of ethnic cleansing and genocide from the seven Years' War and the division and absorption of large portions of the former Polish state by Prussia in the late eighteenth century all the way to today, when racist reverse-colonialist notions of "white genocide" are being promoted by terrorist (and only recently uncovered) subsections of the German armed forces. Topics include: Pre-nationalist expansion in the late eighteenth century; the beginnings of German nationalist and racist discourse; imperialist and racialist settlement policies within the German Empire in the second half of the nineteenth century; global racialized policies of space, expansion and genocide in Africa and Asia during the age of imperialism; genocide and mass death during the First World War; Nazi ideology and genocide; genocidal fantasies in post-1945 Germany.

GER 540: Seminar in German Culture and Civilization

3-12 Credits/Maximum of 12

Examination of special problems in German culture and civilization.

GER 561: German Literature of the 19th Century--From Biedermeier to Realism

3 Credits

Survey of major developments in German literature from the mid- to the late-19th century.

GER 571: German Literature from the Turn of the Century to 1945

3 Credits

Advanced survey of German literature from the era of Naturalism to that of Exile literature.

GER 572: Post-War and Contemporary German Literature

3 Credits

Intensive survey of German literature from Gruppe 47 through the literature of the GDR and down to the present.

GER 581: Topics in Literary Genres

3-12 Credits/Maximum of 12

Special studies in the German lyric, drama, short story, and novel.

GER 582: Topics in Germanic Philology and German Linguistics

3 Credits/Maximum of 12

Special studies of modern or older Germanic languages.

GER 589: Technology in Foreign Language Education: An Overview

3 Credits

Approaches to the uses and research applications of multimedia and other educational technologies applied to the teaching of foreign languages. (also crosslisted with SPAN 589)

Cross-listed with: APLNG 589, CMLIT 589, FR 589, SPAN 589

GER 591: German Literary Theory and Criticism

3-6 Credits/Maximum of 6

Examination of major movements in literary theory and criticism with special reference to German literary thought.

GER 592: Seminar in German Literature

3 Credits/Maximum of 12

Focused investigation of a major figure or theme in German literature.

GER 593: Seminar in German Philology and German Linguistics

3 Credits/Maximum of 12

Focused investigation of a major topic in Germanic philology or linguistics.

GER 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects including nonthesis research, supervised on an individual basis and which fall outside the scope of formal courses.

GER 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

GER 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

GER 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

GER 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Instruction of lower division German courses with observation by the supervisor and attendance at regular meetings to discuss classroom techniques.

GER 603: Foreign Academic Experience

1-12 Credits/Maximum of 12

Foreign study and/or research constituting progress toward the degree at a foreign university.

GER 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

Greek (GREEK)

GREEK 520: Greek Mythography

3 Credits

This graduate seminar focuses on ancient Greek mythographic authors from the beginnings of the genre (6th C.B.C.E.) to the Roman period. GREEK 520 Greek Mythography (3) This graduate seminar focuses on the ancient Greek mythographic authors from the beginnings of the genre in the sixth century B.C.E. to the Roman period. We shall define "mythography" simply as the prose exposition of mythic narratives (the most well-known Greek mythographer is Apollodorus, whose first-century C.E. "Bibliotheca" is consulted regularly by students of myth; some of the earlier practitioners include Hellanicus and Pherecydes). The seminar will consider selected readings in the theory of myth, alongside which we will examine in detail and evaluate the content of sources of the mythographers' writings. Some of these provide quite outlandish variants on known myths or bizarre stories otherwise unknown. Through a series of case studies of particular mythic stories, we shall place these texts in literary and cultural relief by seeking to understand how they interact with the more well-known mythic genres of Greece such as epic, lyric, and tragedy. We will also probe the borders of what we call "mythography" by examining other prose texts not normally associated with the genre, such as Herodotus' Histories or even philosophical texts such as Plato or Aristotle. In addition, since much of the material we will treat is in a fragmentary state, we will try our hands at reconstructing both texts and myths that survive in only incomplete form. Some attention will also be given to the Latin mythographic tradition (e.g. Hyginus and others) which is mostly, or perhaps wholly, dependent upon earlier or contemporary Greek mythography.

GREEK 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

Health Administration (HADM)

HADM 506: Management Information Systems for Public and Health Administration

3 Credits

The design, implementation, and purpose of computerized management information systems in health and non-profit organizations.

HADM 510: Organization Behavior

3 Credits

Examines the concepts of human behavior in formal organizations, systems analysis, conceptual models, and decision processes.

Cross-listed with: PADM 510

HADM 539: Health Systems Organization

3 Credits

Health care delivery presented as a socio-technical systems focusing upon resources, policy issues, institutions, technology, and innovations.

Prerequisite: permission of program

HADM 540: Health Administrative Policy Formulation

3 Credits

Analysis of administrative problems from a total organization viewpoint. Case studies of actual organizations are used for analysis.

Prerequisite: permission of program

HADM 541: Health Economics and Policy

3 Credits

Public policy issues, health system components from economic perspective. Economic analysis of health sector, medical markets, health care regulation.

Prerequisite: permission of program

HADM 542: Health Care Politics and Policy

3 Credits

This course reviews political considerations and the policy process as they pertain to health care in the United States.

Prerequisite: permission of program

HADM 543: Long-Term Care Administration and Policy

3 Credits

This course reviews theory and practice related to long-term care administration and policy.

Prerequisite: permission of program

HADM 545: Health Financial Management

3 Credits

Theory and techniques of financial management applied to health organizations; forecasting, control systems, working capital, capital budgeting, and institutional financing.

Prerequisite: permission of program

HADM 546: Health Planning for Public Administration

3 Credits

Comprehensive planning and program planning for health services, facilities, and manpower; social, economic, and political considerations; methodological problems.

Prerequisite: permission of program

HADM 548: Health Care Quality Assurance

3 Credits

This course reviews theory, methods, outcomes, and management of quality assurance in health care organizations.

Prerequisite: permission of program

HADM 551: Health Care Law

3 Credits

Course on health law for administrators with coverage including hospital governance, taxation, licensure, liability, malpractice, patients' rights, anti-trust.

Prerequisite: permission of program

HADM 552: Health Delivery Systems

3 Credits

This course discusses design and implementation of health care delivery systems and the pressure and stakeholders which impact those systems. H ADM 552 Health Delivery Systems (3) This course covers the design and implementation of health care delivery systems. Beginning with policy and environmental pressures, the course considers the interests of diverse stakeholders such as regulators, purchasers, providers and consumers. The content of the course is organized in four areas: (1) traditional delivery systems; (2) managed care concepts and practices; (3) healthy communities approaches; and (4) reform and futures issues. The objective of the course is to increase students' knowledge of the evolving health care delivery systems. This course functions as an elective course in the MHA program. It builds on core courses that have presented the basics of health systems. Students will be required to take a mid-term and final exam and write a term paper (grade 1/3 each). The course will be offered every third semester with an expected enrollment of 20 students.

Prerequisite: permission of program

HADM 594: Research Topics

1-15 Credits

Supervised student activities on research projects identified on an individual or small-group basis.

HADM 595: Internship

1-9 Credits/Maximum of 9

Supervised research-oriented off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

HADM 596: Individual Studies

1-9 Credits

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

HADM 597: Special Topics

1-9 Credits

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

HADM 803: Research Design

3 Credits

This course will identify research methodologies relevant to administration, planning, and public policy. The students will distinguish and demonstrate qualitative and quantitative research approaches, demonstrate and employ various research designs and research methods, demonstrate the process of "doing research," "writing research," and "presenting research", and demonstrate an awareness of ethical issues in conducting research. This course is intended for health professionals.

HADM 897: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

Health and Human Development (HHD)

HHD 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

Health Education (HLHED)

HLHED 501: World Health Promotion

3 Credits

Analysis of the various health problems that affect humans throughout the world; emphasis will be placed on personal health issues.

HLHED 530: Research Techniques in Health Education

3 Credits

Research techniques, including methods, research design, techniques for data collection, as applied to relevant problems in the health education field.

HLHED 552: Current Health Education Issues

3 Credits

Analysis of scientific and political foundations of current issues within health education tasks, with emphasis on research and action implications.

HLHED 553: Multicultural Health Issues

3 Credits

This course is designed to explore cultural factors influencing the health status among racial/ethnic groups in the United States. HLHED 553 Multicultural Health Issues (3) This course is designed to explore ethnic and cultural factors influencing the health status among racial/ethnic groups in the U.S. Through lecture, discussion, simulations, and case studies, the students will be able to develop an appreciation for the cultural traditions and practices of different groups. The importance and implications of these traditions on health outcomes and health status will be examined. The students will also learn skills of cultural competence that are essential for public health practitioners.

HLHED 582: Spirituality and Culture in Health and Education Professions

3 Credits

This course focuses on the cultural aspects of spirituality and its place in the health and education professions. EDUC (HLHED) 582 Spirituality and Culture in Health and Education Professions (3) This course will focus on the examination of the place of the cultural aspects of spirituality and its place in the education and health professions and its implications for culturally responsive education and/or health care in a multicultural society. In particular the goals of the course are as follows: 1) To clarify the difference between spirituality and religion and to understand how spirituality is currently being examined in the fields of adult education, medical education and the health professions. 2) To examine how culture informs spirituality generally, and more specifically, to examine how culture relates to one's own spiritual development and overall health in the world. 3) To develop a sense of how people construct knowledge through image and symbol, which for many people, maps to their spirituality and culture, as they make new and deeper meaning of their own lives. 4) To begin to consider WHEN and HOW one might appropriately draw on one's own spirituality and that of participants in adult and higher educational practices and health care settings to increase cultural understanding and/or responsiveness to patient needs and when such discussion might seem to impose a spiritual or religious agenda. 5) To examine the connections among spirituality, culture, some

complementary and alternative medicine modalities and overall holistic health and education.

Cross-listed with: EDUC 582

HLHED 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

HLHED 591: Capstone Seminar in Health Education

3 Credits

Culminating or capstone experience for students in the M. Ed. program in Health Education.

Prerequisite: completion of 15 credits in the program and permission of advisor

HLHED 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

HLHED 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

Health Policy and Administration (HPA)

HPA 503: Health Services Organizational Behavior

3 Credits

A systematic application of the principles of organizational behavior to understanding professional roles in health services organizations.

HPA 506: Design and Evaluation of Prevention and Health Promotion Programs Across the Life Span

3 Credits

Addresses theory and application of program evaluation, emphasizing process and outcome evaluation strategies for programs involving individuals, organizations and populations. HDFS (HPA) 506 Design and Evaluation of Prevention and Health Promotion Programs Across the Life Span (3) This course is designed for graduate students interested in the design and evaluation of programs in a wide range of human services (e.g., health care, social services, education). The course provides a foundation in the theory and application of program evaluation, with focused attention to the details of how such work can be proposed and conducted. The majority of the semester will focus on issues related to developing scientifically sound and viable studies of interventions in line with students' interests. The goals for this course are to help students build the knowledge and confidence to evaluate human service programs and/or policies that are implemented in research settings (academic

or government) and communities or community settings (e.g., schools, health care facilities, community agencies).

Prerequisite: HD FS503 and HD FS516 ; or H P A564
Cross-listed with: HDFS 506

HPA 510: Health Services Financing and Policy

3 Credits

Introduction to health policy focusing on health services financing, insurance and other current health policy topics. HPA 510 Health Services Financing and Policy (3) The second in a two-course sequence that introduces graduate students to the organization, financing, and delivery of health services in the US. This course focuses on health services financing and policy. This course will cover policy issues in the federal Medicare program, state Medicaid programs and private health insurance markets, and other important current health care policy issues. The course will also introduce students to the discipline of policy analysis, primarily the economic perspective, but will also include discussions on the political perspective and the policy-making process. The objectives of this course are to help students: 1) Understand the mechanisms by which Americans pay for their health care and become familiar with current health policy issues. The topics covered in this course will serve as a context for key policy issues that will be intensively discussed in a paired research seminar course; 2) Appreciate the policy-making process and the role of political perspectives in the formation and implementation of policy proposals; 3) Understand approaches of policy analysis, which will provide them with an analytic framework for critiquing health policy issues as well as health services research; 4) Develop policy analysis skills.

HPA 511: Research Seminar on Health Services Financing and Policy

3 Credits

An examination of seminal and current research on health services financing, insurance and health policy. HPA 511 Research Seminar on Health Services Financing and Policy is one of two seminars designed to complement introductory courses in the graduate H P A curriculum. This course allows graduate students seeking careers in health services research to engage in deeper study and discussion of the classic and current research on the issues of payment, insurance, regulation and policy related to health care delivery in the U.S. health care system and to begin to explore their research interests for a thesis. The primary objectives of the course are: (a) to help students become familiar with a selection of "classic" and "cutting edge" papers in the field of health services research (b) to develop students' ability to critically read and analyze the health services research literature with an emphasis on the conceptual and methodological approaches used by researchers (c) to assist students in developing their ability to organize, synthesize and integrate research drawn from a variety of disciplinary approaches into a coherent foundation for further study in health services research (d) to improve students' oral and written communication skills, emphasizing organization, clarity, and the ability to give and respond to constructive professional criticism The readings for this class are all drawn from important journals in the field of health services research. Class will generally include 2 or 3 different activities designed to meet the objectives above. During each class, we will spend some time discussing the assigned articles to review the key points, analyze strengths and weaknesses of the research design, and consider how they provide a framework for studying the issues. In some classes, students will be asked to provide a short oral presentation of a topic, complemented by a written summary of the presentation topic. The class will discuss the

paper and presentation, giving students constructive critical feedback on the presentation and paper. Finally, in some classes, the entire class will collaborate in developing a research question into a basic research proposal. Students will be responsible for writing papers, giving presentations, preparing written critiques of articles as a seminar class, the full participation of every student is necessary. Students must not only come prepared to class, they must be active participants in all aspects of the class each week. Grades in the class are based on oral presentations, written papers, article critiques and student participation.

Prerequisite: H P A510; Concurrent: H P A510

HPA 518: Basic Analytic Methods for Health Services Research

3 Credits

This course provides an overview of basic methods for undertaking research pertaining to health services organizations and systems. In addition to basic methods, the course also provides "the current state of the art" in health services research. Students will gain an understanding of research design, statistics, and methodology while developing critical thinking and analytical skills to examine the health services research literature. Students will also develop and demonstrate effective presentation skills and engage in detailed discussions about current and emerging areas of health services research. This course is recommended for students who do not have an extensive background or training in statistical methods but who will be carrying out policy research, social science research, or program impact evaluation. It is also relevant to those who will apply the results of Health Services Research (HSR) done by others.

HPA 520: Introduction to Health Services Organizations and Delivery

3 Credits

Introduction to health systems, health services organization and health care delivery focused on trends, problems and issues.

HPA 521: Research Seminar on Health Services Organization and Delivery

3 Credits

An examination of seminal and current research on health services organization and delivery, emphasizing costs, access and quality. HPA 521 Research Seminar on Health Services Organization and Delivery (3) HPA 521 is one of two seminars designed to complement introductory courses in the graduate H P A curriculum. This course allows graduate students seeking careers in health services research to engage in deeper study and discussion of the classic and current research on the issues of health services organization and delivery in the U.S. health care system and to begin to explore their research interests for a thesis. The primary objectives of the course are: (a) to help students become familiar with a selection of "classic" and "cutting edge" papers in the field of health services research (b) to develop students' ability to critically read and analyze the health services research literature with an emphasis on the conceptual and methodological approaches used by researchers (c) to assist students in developing their ability to organize, synthesize and integrate research drawn from a variety of disciplinary approaches into a coherent foundation for further study in health services research (d) to improve students' oral and written communication skills, emphasizing organization, clarity, and the ability to give and respond to constructive professional criticism The readings for this class are all drawn from important journals in the field of health services research. Class will generally include 2 or 3 different activities

designed to meet the objectives above. During each class, we will spend some time discussing the assigned articles to review the key points, analyze strengths and weaknesses of the research design, and consider how they provide a framework for studying the issues. In some classes, students will be asked to provide a short oral presentation of a topic, complemented by a written summary of the presentation topic. The class will discuss the paper and presentation, giving students constructive critical feedback on the presentation and paper. Finally, in some classes, the entire class will collaborate in developing a research question into a basic research proposal. Students will be responsible for writing papers, giving presentations, preparing written critiques of articles as a seminar class, the full participation of every student is necessary. Students must not only come prepared to class, they must be active participants in all aspects of the class each week. Grades in the class are based on oral presentations written papers, article critiques and student participation.

Prerequisite: H P A520; Concurrent: H P A520

HPA 523: Managerial Epidemiology

3 Credits

Introduction to the principles and methods of managerial epidemiology and its application to health care. HPA 523 Managerial Epidemiology (3) This course is intended to familiarize students with the methods and principles of managerial epidemiology. Changes in the structure of the health delivery and financing systems are making managers more responsible for the health of enrolled and constituent populations. The tools of epidemiology are important for purposes of planning, monitoring, and evaluation of population health. Managing the health of populations requires both an understanding of the factors that influence population health and how those factors can be influenced by health care organizations and systems. In addition to the management of population health, the methods of managerial epidemiology can be applied to organizational evaluation and clinical practice improvement. Epidemiology, interaction between health behavior and health management, health interventions, quality improvement, outcomes management, and program implementation and evaluation methods are examined. Particular emphasis is given to health management applications aimed at vulnerable populations, such as racial/ethnic minorities and the elderly.

Prerequisite: H P A521

HPA 524: Management of Health Services Organizations

3 Credits

A systematic study of the roles of health services managers and the organizational and environmental context within which they work.

HPA 525: Health and Health Services Across the Life Course

3 Credits

Explores health and health services across the life course using a population health approach.

HPA 526: Health Disparities

3 Credits

This course provides an overview of social factors that lead to demographic disparities in health. H P A(SOC) 526 Health Disparities (3) This course provides a broad exploration of U.S. health disparities. In particular, it examines several types of U.S. health disparities that emerge

as a result of individuals' race/ethnicity, socioeconomic status, nativity status and gender. The course focuses on theoretical and methodological strategies for studying health disparities as well as empirical evidence supporting the existence of different health disparities and explanations for understanding and ameliorating them. Students will summarize and discuss weekly readings and apply course materials to understand the state of the field and to carry out an original research project on a particular health disparity that interests them. This course fulfills basic seminar requirements in the Sociology graduate curriculum and serves as a process course for the interdisciplinary Demography dual-title graduate curriculum.

Cross-listed with: SOC 526

HPA 527: Managing Healthcare Operations

3 Credits

This course is focused on understanding and overcoming the challenges associated with nurturing and managing effective health care operations. H P A 527 Managing Healthcare Operations (3) This course is focused on understanding and overcoming the challenges associated with nurturing and managing efficient and effective health care operations. It exposes students to the frameworks, theory, and skills commonly employed by managers in an effort to deliver excellence in health care services. The course begins by considering process management and improvement, including the fundamentals of process analysis, queuing theory and staffing applications. The course concludes by taking a step back from specific processes to consider operating systems as a whole. Specifically, the concluding module of the course focuses on how the design of an operating system can impede or enhance the effectiveness of the organization's processes, including the role of complexity and tradeoffs healthcare organizations face between focus and flexibility.

Prerequisite: H P A520 and H P A503

HPA 528: Health Data Analysis for Research

3 Credits

Introduction to data sources and use of software for data management and analysis in health services research. H P A 528 Health Data Analysis for Research (3) The statistical analysis of quantitative data is a major tool for health services researchers. This course provides students with an overview of practical, concrete information about identifying, acquiring, processing, and analyzing data in typical health service research settings. The course covers three main content areas: Data issues in health services research, including legal and ethical information on human subjects and private health information; manipulating primary and secondary health services research data to create files amenable to research analysis; and basics of descriptive and exploratory analysis of health services research data. The objectives of the course are: (1) to give students a solid foundation of knowledge about health services data issues for their thesis and related research projects in the future; (2) to give them practical experience manipulating commonly used data sets in health services research; and, (3) to allow them to begin to explore potential research hypotheses for thesis and other research. Its primary role is to guide students in the master's of science and doctoral programs in Health Policy and Administration as they begin to explore research. It is also appropriate for other graduate students who intend to do research in or related to health services research.

Prerequisite: STAT 500 or equivalent preparation in probability and statistics

HPA 540: Epidemiological Applications in Health Services Research

3 Credits

The course emphasizes theoretical as well as practical issues relating to applying advanced methods of epidemiology in health services research. H P A 540 Epidemiological Applications in Health Services Research (3) Advanced methods of epidemiology are presented with examples and exercises. The course emphasizes theoretical as well as practical issues. Students will identify opportunities for implementing the epidemiological principles in health services research. Students will also have the chance to explore the existing secondary data resources and/or to collect primary data and prepare them for epidemiological analysis. The course examines various applications of epidemiological methods in health services research. It focuses on the design and implementation of research projects utilizing epidemiological techniques to study the health of an identified population (Pennsylvanians), using data that is part of a national program, Behavioral Risk Factors Surveillance System (BRFSS) run by the Centers for Disease Control and Prevention in all states.

Prerequisite: H P A440 , H P A528

HPA 541: Poverty, Race, Ethnicity and Child Health

3 Credits

Seminar focusing on disparities in infant, child, and adolescent health, and policies and programs impacting these disparities. HPA 541 Poverty, Race, Ethnicity and Child Health (3) This course is designed to 1) strengthen students' understanding of the multidimensional nature of health and well-being at each stage of childhood and adolescence, and the magnitude of health disparities that exist among children of differing socioeconomic position and race/ethnicity; 2) encourage critical evaluation of existing governmental policies and programs impacting children's health and health disparities, and exploration of other potentially effective approaches; and 3) enhance students' expertise in the synthesis, critical analysis, and presentation of material in class and in written form. The content of this course is relevant not only to students in the Health Policy and Administration program, but also for students in other disciplines including but not limited to Demography, Human Development and Family Studies, Biobehavioral Health, Nutrition, and Nursing who are interested in learning about children's health and health disparities. Students are expected to participate actively in all class discussions and homework assignments, lead the class in the discussion of a specific government program impacting children's health, write a short reaction paper on the class text, write a final term paper on socioeconomic and racial/ethnic disparities in an aspect of children's physical or mental health including evaluation of current and potential policy approaches for addressing these disparities, and present the major points made in the term paper to the class for discussion. This course will be offered once a year, with enrollment limited to 20 students.

HPA 545: Introduction to Health Economics

3 Credits

Survey of the application of economics to the roles of markets and government in health care.

HPA 546: Assessing the Value of Health Interventions

3 Credits

This course prepares students to evaluate and conduct basic and applied research using cost-effectiveness analysis and other value assessment frameworks to shape evidence-based policy on the use, coverage and pricing of pharmaceuticals and other health interventions. The course uses recent literature to emphasize the connection between methodology and the evolving health technology assessment policy landscape in the US and around the world. Students will gain understanding of methodological, empirical, ethical and political challenges in assessing the value of health interventions (and in using those assessments to affect access, use and payment for health interventions) from the perspective of patients, health systems and society.

Recommended Preparation: Prior experience in one or more of the following is likely to be useful: health economics, cost-effectiveness/cost-benefit/decision-analysis, health system engineering, biostatistics, epidemiology, and/or clinical trials.

HPA 551: Quality Improvement in Healthcare

3 Credits

Examination of major approaches to performance improvement in contemporary healthcare systems. H P A 551 Quality Improvement in Healthcare (3)The goal of this course is to provide students with requisite knowledge and skills for managing quality improvement and patient safety efforts in health care organizations. The various perspectives on the challenges of providing safe and reliable health services are covered. Operational approaches to quality improvement adapted from industry are examined and practiced in cases and exercises. Students learn to identify key aspects of systems and work flows. They employ currently used analytic tools to analyze quality-related systems problems and identify potential solutions. Finally, the course will assist students in improving management skills in the affective realm. Specifically, excellent performance in this competency realm will be demonstrated through: (a) persuasive written and verbal communication skills; (b) the ability to facilitate group problem solving in a situation that includes conflict; and (c) the ability to effectively navigate difficult conversations. The teaching and learning methods used in the course will include lectures by the instructor (usually brief), briefings by students, discussion, role play and other structured active learning exercises. Weekly class process reflections will be used for improvement purposes. The class serves as part of the culmination of the professional master's degree program. It is also appropriate as an elective course for students in master's and doctoral programs who are interested in research and applications in quality improvement in health care.

HPA 556: Strategy Development in Health Services Organization

3 Credits

Integration of prior course work in the program to develop a strategic plan for a health services organization.

Prerequisite: H P A523 , H P A524 , H P A835

HPA 561: Introduction to Research Design in Health Services Research

3 Credits

Review and critical analysis of state-of-the-art health services research methods.

HPA 562: Economics Applications in Health Services Research

3 Credits

Application of theoretical and empirical tools of microeconomics to issues in health services utilization and delivery.

Prerequisite: H P A445 or H P A545

HPA 563: Organizational Studies in Health Services Research

3 Credits

Applications of theoretical and empirical tools of organizational studies in the delivery of health care.

Prerequisite: H P A503

HPA 564: Research Methods in Health Services Research

3 Credits

Introduction to regression models in health services research, including violations and tests of model assumptions and solutions for those violations. HPA 564 Research Methods in Health Services Research (3) This course is the initial course on health services research methods for master's of science and doctoral students in the Department of Health Policy and Administration. In the context of the typical types of data used by health services researchers, students are introduced to the basic linear regression models that are fundamental for understanding more complex modeling of health care data. The course also reviews common data problems in health services research, including heteroskedasticity, serial and auto-correlation, and limited dependent variables. The objectives of the course are: to help students understand the theoretical and practical aspects of applying linear regression models to health care data; to help students understand the typical ways in which health care data often lead to violations of the assumptions of linear regression to develop students' knowledge and skills in being able to use statistical models to test for and correct health data for heteroskedasticity, serial and autocorrelation to introduce students to binary response models that are ubiquitous in health services research.

Prerequisite: STAT 500

HPA 566: Advanced Methods in Health Services Research I

3 Credits

Advanced topics course focusing on extensions of the ordinary least squares regression model and nonlinear methods in health services research. H P A 566 Advanced Methods in Health Services Research I The objectives of this course are to help students identify problems that may arise in health services research data, understand methods designed to address such problems, and apply those methods to problems that they encounter in their empirical work. This course is part of the methods core in the HPA doctoral curriculum, and builds from students' introduction to research methods which is a pre-requisite course. Students should have a strong foundation in statistical and research methods prior to taking H P A 566. After completing the course, students should be prepared for the beginning stages of data analysis for a thesis and for further advanced level study in health services research methods. Evaluation is based on homework and examinations.

Prerequisite: H P A564

HPA 567: Advanced Methods in Health Services Research II

3 Credits

Application of advanced methods to health services research topics focused on empirical approaches to causal inference in nonexperimental data. HPA 567 Advanced Methods in Health Services Research II (3) The main theme of the course will be estimating causal effects using non-experimental data in health services research. These general topics, and the associated estimation methods, often go by other names; in economics they are referred to as "identification strategies," while in other disciplines they are sometimes labeled "quasi-experimental research designs." Causal inference is one of the main issues to confront in conducting health services research. Devising empirical strategies that increase the likelihood that estimates have a causal interpretation is one of the primary objectives of health services researchers. The course will have a distinctively applied bent. The goal will be to survey as many estimation strategies as possible, with particular emphasis placed on those most commonly used by empirical researchers. The objectives will be to understand the strengths and weaknesses of the various approaches, the assumptions they require, and how they have been used in practice.

Prerequisite: H P A564

HPA 580: Seminar in Innovation and Research Formulation

3 Credits

The goal of this course is for students to gain experience in the process of innovation and research formulation that is necessary for successful completion of the doctoral dissertation and for future research in the fields of health economics, health services research, population health, and health policy. Students will learn how to critically assess emerging research in these fields and define their own research questions by focusing on study significance, innovation, research design, impact, and limitations. An emphasis will be placed on identifying promising lines of research, as opposed to individual projects, and on determining strategies for optimizing research output and impact.

Prerequisite: HPA 510 and HPA 511 and HPA 561 and HPA 564

Recommended Preparation: The course is intended primarily for students who have either completed or received transfer credit for required first-year courses in the HPA PhD program.

HPA 590: Colloquium

1-3 Credits/Maximum of 3

Introduction to the field of health services research.

HPA 595: Internship

1-18 Credits/Maximum of 18

Supervised off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

Prerequisite: prior approval of proposed assignment by instructor

HPA 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

Cross-listed with: CSPD 596

HPA 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

HPA 600: Thesis Research

1-15 Credits/Maximum of 999

NO DESCRIPTION.

HPA 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

NO DESCRIPTION.

HPA 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 3

Supervised and graded teaching experience in selected undergraduate Health Policy and Administration courses.

Prerequisite: completion of minimum of three semesters of graduate work in health policy and administration

HPA 610: Thesis Research Off-Campus

1-15 Credits/Maximum of 999

NO DESCRIPTION.

HPA 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

NO DESCRIPTION.

HPA 800: Ethics in Health Services Organizations

3 Credits

This course is designed to examine the theories and frameworks that underlie the influence of values and ethics (personal, professional, organizational, and social) on leadership practices in healthcare organizations, and to challenge students to examine their own ethical assumptions. The primary emphasis of this course is on the values held by individuals and their impact on the administrative problem-solving processes. Values conflicts will be explored in the context of individual values clashes with the broader organizational and social values held by healthcare organizations. Students will be exposed to a broad range of theoretical literature on values and ethics, but the primary focus of this course is on the development of practical leadership knowledge and skill that will lead to more reflective, intelligent, and principled practices. The primary course goal is to provide students with the tools to be more effective when confronting issues that have ethical implications in their own organizations. Using case studies and interactive discussions, this course will examine the ethical decision-making process and confront the ethical challenges that healthcare leaders will face.

HPA 805: Change Leadership in Health Services Organizations

3 Credits

Exploration of diagnostic and intervention strategies employed in planned change in health services organizations and programs.

HPA 806: Project Management in Health Services Organizations

3 Credits

The project management framework of this course will allow students to enhance previously attained competencies and acquire advanced skills while addressing ever-evolving project management challenges specific to the health care services organizations. The assignments will focus on enterprise-wide thinking while engaging in cross-functional relationships as they work to meet project goals. Students will continue to layer and build previously developed competencies in finance, operations, leadership, human resources, law, marketing, and organization behavior specific to the health care services industry. In order to explore multiple perspectives, students will rotate into various executive roles as well as project manager and receive feedback on their performance. The course structure will give each student an opportunity to reflect on choices, assess progress to goals, and evaluate successes and failures in a supportive environment while striving for continual performance improvement within the project.

HPA 807: Quality and Safety in Health Services Organizations

3 Credits

This course is designed to provide students with the requisite knowledge and skills for leading quality improvement and population health management efforts in health services organizations. The various perspectives on the challenges of providing safe and reliable health services are covered. Population health will focus on the identification and stratification of populations at risk; evidence-based care, care coordination, patient and community engagement and data analytics and reporting of outcomes. Operational approaches to quality improvement adapted from within health care and other industries are examined and applied. Students will employ currently used analytic tools to investigate systems problems and to identify potential solutions.

HPA 808: Human Resource Management in Health Care Organizations

3 Credits

This course is designed to provide students with requisite knowledge and skills for leading and creating the organizational and cultural structure that will positively support the management of human capital. Students will explore the human capital theory of people management, and will apply the principles. Concepts will be placed into operational context using case situations and reading materials. Students will explore the principles of human resource management including; workforce development, succession planning, employee development, selecting the right members of the team, and supporting those team members through effective leadership and management techniques, and will have the opportunity to apply the tools to their own unique organizational situations.

HPA 809: Applied Finance for Health Services Organizations

3 Credits

This course provides students with an understanding of financial management principles as applied to health service organizations.

The course emphasizes health care financial management concepts and terms, health care management techniques and their use, and the interpretation and analysis of financial information in health service organizations.

HPA 810: Advanced Financial Concepts for Health Services Organizations

3 Credits

The purpose of this course is to apply the theory and principles of accounting and finance to management decision making in health care organizations. Case studies are used to simulate the context in which financial decisions are made. Case settings include a wide variety of provider organizations, including hospitals, clinics, medical practices, and home health organizations, as well as integrated delivery systems, managed care organizations, among others.

Prerequisite: HPA 809

HPA 811: Legal Concepts for Health Services Organizations

3 Credits

This course explores the legal issues commonly found in the U.S. based health services organizations, and investigates the health care professional as decision-maker and leader. This course will familiarize the health care administrator with a basic understanding of the challenges and opportunities the law provides at the state and federal levels and the legal issues associated with delivery of care in health organizations. Students will gain practical understanding and best practices that they can utilize in their current and/or future roles. The course will guide students through exercises that allow them to understand the contemporary role law plays in the health care industry.

Prerequisite: HPA 802

HPA 812: Health Care Marketing

3 Credits

Healthcare marketing is designed to introduce students to the theory, concepts, skills, and principles of marketing applied to health-related organizations. Key marketing concepts, including assessing the external environment, identifying opportunities and gaps between strategy and capabilities, product or service development and management, and communication channels and strategies. Participants must have a basic knowledge of the US healthcare system, including key stakeholders, national trends in health delivery, financing and health policy. Students will employ marketing tools in solving problems using case studies. The course employs active learning through projects and cases to achieve learning objectives. Students will demonstrate mastery of skills through written assignments and oral presentations. Analytical skills will be employed to assess market indicators as well as for monitoring internal metrics.

Prerequisite: HPA 802

HPA 813: Information Systems in Health Services Administration

3 Credits

This course is designed to provide students with a working knowledge of issues surrounding the design, evaluation and use of information systems in the health services sector. The course uses discussions, cases, and projects to lead the student to think critically about the management of Information Systems (IS) in the health care setting.

Students do not learn how to design health IS components. Rather students seek to understand the components of IS, how IS are used to improve operational effectiveness, analytics, and current topics in IS. In brief, this course provides foundations of IS for supporting clinical services, patient safety, quality improvement, and administrative functions in health services management.

Prerequisite: HPA 802

HPA 822: Clinical Issues for Health Services Management

3 Credits

Introduction to current clinical issues in health services organizations focusing on the role of managers. H P A 822 Clinical Issues for Health Services Management (3) This course is designed to provide the clinical aspect to the HPA graduate students' education, an important component of understanding population health and status assessment. It will allow students to gain exposure and utilize important clinical technologies which are used to formulate patient diagnoses. Students will also apply their knowledge in designing treatment plans for patients through hypothetical case studies. All students will learn basic medical vocabulary and terminology that is used in the field of medicine and will gain an understanding of the pathophysiology, diagnosis, prevention and treatment of common diseases. Students will gain an awareness of methods of health promotion and apply that knowledge to real life and hypothetical cases. This class will focus on the clinical aspects of medicine. By the end of this course, students will have the necessary skills and knowledge to:

1. Describe and identify technologies used to diagnose and treat diseases.
2. Demonstrate in written and oral work an understanding of the basic pathophysiology, diagnosis and treatment of common diseases.
3. Compose written and oral work displaying a basic knowledge of commonly used medical terminology.
4. Recognize the clinical approach that health care providers take in diagnosing and treating common disorders, including tools and analytical thought process used in providing quality care.
5. Demonstrate a working understanding of the importance of computers and information technologies used in patient care.
6. Utilize health care resources such as the internet to analyze and examine health care topics.

This course will contribute to the student's development in:

1. Information seeking. Students will be responsible for acquiring knowledge from lectures, text books, medical journals, the internet, presentations, question and answer time with medical professionals and other resources needed to understand disease processes involving many organ systems.
2. Analytical thinking. Discussions will focus on decision-making skills used in clinical care and transferable to non-clinical settings. Students will need to use the knowledge gained in class and apply learned analytical skills comprehensively to evaluate and analyze the health care delivered to a specific healthcare consumer.
3. Communication skills. Students will be expected to use accurate and complete information in preparing for and participating in classroom discussions and presentations.

HPA 896: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

HPA 897: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

HPA 897D: **SPECIAL TOPICS**

1 Credits

Hebrew (HEBR)

HEBR 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

Higher Education (HIED)

HIED 501: Foundations of Higher Education

3 Credits

This course intends to explore what might be called the landscape of U.S. higher education. Acknowledging that a majority of the program's students enter the doctoral program from a wide variety of disciplines and fields, this course is intended to give students an overview of past and current research in four overarching areas of inquiry that a majority of higher education researchers pursue. The four organizing themes are: foundations of higher education; college students; administration and organization in higher education; and, equity and diversity in higher education. Students will recognize that these four themes also intentionally correspond to the four areas in which they eventually must demonstrate competency (i.e., analytical comprehension and significance of the research). In examining the research in each of these four arenas of inquiry, students will consider various perspectives that higher education researchers commonly utilize including economic, historical, sociological, cultural, and legal perspectives.

HIED 502: Diversity & Equity in Higher Education

3 Credits

This course focuses on foundational and current issues related to equity and diversity in higher education. This course is organized into three major areas and levels of analysis: (1) an understanding of inequality and the framing of equity; (2) the diversity frame; and (3) strategies for transformation. The course will explore the concept of equity from different theoretical perspectives and an understanding of inequality from a structural, organizational, and individual level. In the second part, the course will explore what the diversity frame is, what its limitations are, and its relation to legal developments and affirmative action. The third part will focus on action, with specific strategies for transformational change toward greater equity and meaningful diversity and inclusion in higher education. Various types of equity and diversity will be considered, but special attention will be given to the complexity of race.

HIED 503: Ethnicity, National Identity, and Education

3 Credits

Surveys group-oriented education policies internationally, especially comparing those of Britain, Taiwan, India.

Cross-listed with: CIED 503, EDTHP 507

HIED 505: College Student Development

3 Credits

This course covers the knowledge and methods of human development theories and their applications in college settings.

HIED 515: Foundations of Educational Research

3 Credits/Maximum of 999

Students read the philosophical foundations of education research, study how philosophies influence methodologies, and analyze current educational problems. This course is designed for students entering doctoral programs in the College of Education. Our students are studying to become education researchers within a highly politicized environment. For example, particular definitions of education research and government policies that favor some types of research practices over others provide opportunities for and set limits upon the work of education researchers. Public controversies likewise contribute to challenges faced by education researchers who find their work affirmed or discounted by particular definitions and policies. In order to explore these controversies and to allow students to begin identifying their own "positionality" with regard to research, this course begins with a reading of the history and philosophies of education research (primarily focusing on the United States). The course goals are: - to identify underlying assumptions of competing forms of social inquiry, each determined to uncover new knowledge; - to bring those assumptions to bear on education research in chosen fields of study; and - to begin to develop one's own positions in order to direct further study and research. Specifically, through instructor facilitation and group discussions, students will come to understand major philosophical perspectives that permeate and drive research methodologies in education: positivism, postpositivism, interpretivism, critical theory, poststructuralism, and pragmatism. These understandings allow students to recognize the methodological assumptions that inform published research studies and to discover how methodologies might inform the research they wish to conduct as students and practitioners. Although the course is not required by any particular doctoral program in the College of Education, it is suggested for students who consider research important to their future careers and who see benefits in exploring the methodological options available.

Cross-listed with: ADTED 515, CI 515, EDPSY 515

HIED 521: Data Analysis for Education Research

3 Credits

This course bridges theoretical statistics coursework and practical research with real, large-scale data sets. The course emphasizes hands-on data preparation and analysis using statistical software. More specifically, the course will give an overview of national and international data resources that are available for educational researchers, survey the most widely used data analysis techniques in educational research, and use statistical software and large-scale datasets to produce useful results for educational policy research.

Cross-listed with: EDLDR 521, EDTHP 521

HIED 522: Economics of Education

3 Credits

The aim of the course is to help students view the educational system and students' educational decisions through the lens of economics. We will discuss the methods that economists commonly employ to study education and read recent empirical articles that examine the impact of educational policies and practices. At the end of the semester, we will discuss insights from the field of behavioral economics, which builds on the standard economic model to better understand decision making. This course also surveys the empirical literature on the economics of education which is organized into several broad topics, including human capital and economic return to education, school choice and college access, and education production. Finally, the course covers a variety of econometric methods that are widely used in the economic study of education. These methods include regression models (e.g., ordinary least squares, discrete choice models, Multi-level modeling, panel data models, etc.) and commonly used techniques to deal with self-selection and causal inference (e.g., quasi-experimental methods).

Cross-listed with: EDLDR 522, EDTHP 522

HIED 524: Comparative Education Research Using Large-Scale Data

3 Credits

This course is designed to give students an overview of large-scale international assessment databases and to demonstrate how these databases can be utilized to investigate critical issues in education from a comparative perspective. A number of empirical studies using large-scale international assessment databases will be reviewed, and these analyses will be replicated via computer labs. Students will develop a good understanding of large-scale international assessment databases and will learn to apply an appropriate method to address a particular topic of interest. Students will also develop a wide range of research skills necessary to independently conduct comparative research, including but not limited to formulating a research question, conducting a literature review, analyzing empirical data, and interpreting results. Although the focus is mainly on datasets relevant to education and education policy research, the skills taught in the course are broadly transferable to other social sciences including sociology.

Recommended Preparations: Students should have taken either EDTHP 513 and EDTHP 538 or EDTHP 553 as well as EDPSY 505 or SOC 574 before enrolling in this course.

Cross-listed with: CIED 524, EDLDR 524, EDTHP 524

HIED 545: Foundations in Higher Education and Student Affairs

3 Credits

Foundations in the policy context and student characteristics of postsecondary education; analysis of issues and future trends in the field. HI ED 545 Foundations in Higher Education and Student Affairs (3) This course provides an overview of the basic structures, functions, participants, constituencies, tensions, and challenges facing higher education and student affairs in the United States. The course goals are to (1) introduce students to the overall structure of higher education and student affairs, (2) examine the societal and individual purposes of higher education, (3) gain exposure to key concepts in higher education and student affairs, (4) examine internal and external actors important to higher education and student affairs, (5) understand the roles of

various individuals in colleges and universities, (6) evaluate contemporary challenges facing higher education and student affairs, and (7) provide an opportunity for students to improve their analytical and written and oral communication skills.

HIED 548: Curriculums in Higher Education

2-3 Credits/Maximum of 3

Various types of curriculums and philosophies underlying them; ways in which curriculums are developed; elective versus required courses; evaluation of achievement.

HIED 549: Community Junior College and the Technical Institute

2-3 Credits/Maximum of 3

Distinctive contributions to meeting the need for postsecondary education; development, functions, curriculum and instruction, government, administration, and finance.

Cross-listed with: ADTED 549

HIED 552: Administration and Organization in Higher Education

3 Credits

This course gives students an overview of research on administrative practice and organizational theory relating to higher education. Students will learn about theory, organizational structure, governance, leadership, decision-making, culture, resources, and change. To prepare students for future research, the primary assignments require students to apply organizational theory to aspects of higher education that students select themselves.

Prerequisite: courses or experience in higher education

HIED 553: Educational Mobility in Comparative Perspective

3 Credits

Role of education in social mobility, using quantitative, qualitative, and historical methods; focuses comparatively on Britain, East Asia, and South America. CI ED 553/SOC 553/EDTHP 553/HI ED 553 CI ED 553. (SOC 553, EDTHP 553, HI ED 553) Educational Mobility in Comparative Perspective (3) Sociologists interested in higher education have attended to the relationships between postsecondary institutions and other institutions, as well as the impact on higher education of general social and demographic processes. Many of the classical ideas in sociological theory, including those of Max Weber and Emile Durkheim, have surfaced in recent debates over the nature of higher education. Sociologists in the U.S. have explored such questions as: the gatekeeping function of higher education; the impact of universities on stratification; and the socializing environment for women and minorities. This seminar introduces some of the classical theorists and contemporary researchers of the sociology of higher education. All seminar participants will be required to write a sample research proposal, based on the readings from the seminar.

Cross-listed with: CIED 553, EDTHP 553, SOC 553

HIED 554: The History of American Higher Education

3 Credits

An examination of the development of American higher education against the background of influential social, political, economic, and intellectual issues.

HIED 556: Higher Education Students and Clientele

3 Credits

Characteristics of higher postsecondary education students and other clientele; changes during postsecondary education years and during college; educational challenges and responses.

HIED 557: Sociology of Higher Education

3 Credits

Reviews theory and current sociology research on student access, achievement, and governance in postsecondary education, with applications to policy analysis. EDTHP (HI ED, SOC) 557 Sociology of Higher Education (3) Sociologists interested in higher education have attended to the relationships between postsecondary institutions and other institutions, as well as the impact on higher education of general social and demographic processes. Many of the classical ideas in sociological theory, including those of Max Weber and Emile Durkheim, have surfaced in recent debates over the nature of higher education. Sociologists in the U.S. have explored such questions as: the gatekeeping function of higher education; the impact of universities on stratification; and the socializing environment for women and minorities. This seminar introduces some of the classical theorists and contemporary researchers of the sociology of higher education. All seminar participants will be required to write a sample research proposal, based on the readings from the seminar.

Prerequisite: graduate students only, except with permission of instructor; EDTHP/SOC 416 is recommended
Cross-listed with: EDTHP 557, SOC 557

HIED 560: Legal Issues in Higher Education and Student Affairs

3 Credits

Analyzing case law issues of access, student rights, employment, collective bargaining, church/state, etc., relevant to higher education and student affairs. HI ED 560 Legal Issues in Higher Education and Student Affairs (3) This course is designed to teach a process of legal analysis with a focus on issues related to higher education and student affairs. The course exposes the student to a range of administrative problems at the post-secondary level which entail legal implications. The course will help current and prospective administrators in higher education and student affairs to envision the legal dimensions of collegiate-level decision processes. No attempt will be made to provide definitive legal outlines at any stage; that is a task for the institutional attorney, the state attorney general, and the courts. Explicit recognition is made of the importance of law to higher education and student affairs training, but the overall effort will be illustrative rather than comprehensive.

HIED 562: Organizational Theory and Higher Education

3 Credits

Application of social science theory and research to postsecondary education organizations and administration; use of research in administrative practice.

Prerequisite: HI ED552

HIED 571: Comparative Higher Education

3 Credits

Comparative methods of studying structural variations in systems of higher education in principal industrialized nations and other selected countries.

Cross-listed with: CIED 571

HIED 582: Reviewing and Editing Education and Policy Journals

3 Credits

Introduction to education policy journals and the review and editing process; discussion of emerging issues within the academic publishing industry.

Cross-listed with: CIED 582, EDLDR 582, EDTHP 582

HIED 585: Research Design: Implications for Decisions in Higher Education

3 Credits

A capstone course on research design and analytical approaches to support decision-making in administration and policy-making. EDLDR 585 / EDTHP 585 / HIED 585 Research Design: Implications for Decisions in Higher Education (3) By the end of this course you should be able to: (1) Define and explain the following concepts/tools of social science research: The scientific method-Theory and its role, Constructs and variables, Hypotheses and relations, Experimental designs, Quasi-experimental designs and Ex post facto designs. Sampling theory and designs-Survey designs and methods, Approaches to data collection, Measurement reliability and validity, Quantitative analytical designs, and Ethical practices. (2) Apply these concepts/tools in designing a study relating to educational research. (3) Effectively critique both the theoretical bases and methods of a journal article or report of research or policy analysis. (4) Prepare a sound research proposal.

Prerequisite: EDPSY400 , EDPSY406 ; or AG 400 , R SOC573
Cross-listed with: EDLDR 585, EDTHP 585

HIED 586: Qualitative Methods in Educational Research

3 Credits

Exploration of the theoretical framework undergirding qualitative research and its attendant practices and techniques. EDLDR (EDTHP, HI ED) 586 Qualitative Methods in Educational Research (3) This course is the introductory course in the EPS qualitative research methods sequence. This is the first course in a three-course sequence departmental sequence intended to take students from basic knowledge of qualitative methods through mastery of advanced topics. This course was designed specifically to 1) orient students to the various types of qualitative methods most widely used in educational policy research and their theoretical underpinnings; 2) provide training in basic qualitative research

techniques; 3) introduce students to basic research design; 4) provide systematic practice (and feedback) in evaluating qualitative research that would allow students to become sophisticated consumers of qualitative studies; 5) prepare students for the Level 11 course. The course will begin with a brief review the development of qualitative methods in related fields (anthropology, sociology, linguistics) and quickly move on to an overview of qualitative methods in education. Students must have read the material prior to class in order to take part in in-class exercises and discussions. We will focus on key issues such as validity, interpretation and representation. Students will be asked to read studies, assess the general quality of the work, and provide a critical evaluation. Students will study specific methods of qualitative field research, and most weeks we will practice and discuss a particular research technique (e.g. participant observation, focus group interviews). These practice sessions will be informed by relevant readings. Students will practice developing coding schemas as well as get a quick overview of qualitative data analysis (QDA) packages. Finally, in small groups, students will design a basic qualitative study to be presented as a final product in the course.

Cross-listed with: EDLDR 586, EDTHP 586

HIED 587: Education Policy and Politics

3 Credits

The political economy and bureaucratic politics of educational organizations, with special attention to the policy making, implementation, and evaluation processes.

Cross-listed with: EDLDR 587, EDTHP 587

HIED 588: Qualitative Methods in Educational Research II

3 Credits

Advanced study of methods involved in executing and analyzing qualitative research in education. EDLDR (EDTHP, HI ED) 588 Qualitative Methods in Educational Research II (3) The course will provide practical experience with methods of qualitative data collection, data management, and preliminary data analysis that extends and deepens students' understanding of qualitative research in education. The class, limited to 15 students, will take as the focus with inquiry a common "site" around which projects of individual and group interest will be designed. Sessions will take place in "workshop" blocks during which students will present and critique the work of the project. Readings will be interspersed with the practicing of methods. The final project for the course will be the compilation of a synthesized data set that could serve as the basis of further analysis.

Prerequisite: EDLDR586

Cross-listed with: EDLDR 588, EDTHP 588

HIED 594: Research Topics

1-18 Credits/Maximum of 18

Supervised student activities on research projects identified on an individual or small-group basis.

HIED 595: Internship in Higher Education

1-9 Credits/Maximum of 9

Supervised experience in administrative offices, in research, on instructional teams, and in college teaching.

HIED 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and fall outside the scope of formal courses.

HIED 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

HIED 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

HIED 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

HIED 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 9

Preparation and presentation of materials in undergraduate classes under the supervision of a full-time faculty member.

HIED 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

HIED 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

HIED 801: Foundations of Institutional Research

3 Credits

Survey course explores fundamental methods and research on campus decisions, enrollment management, faculty work analysis, institutional effectiveness, accreditation, student outcomes. HI ED 801 Foundations of Institutional Research (3) This is a graduate level course that provides students with an overview of the institutional research profession and the most common functions that institutional research offices carry out. HI ED 801 is a core course in the IR Certificate Program and is designed for higher education professionals who seek to gain a fuller understanding of campus decision support activities and processes such as strategic planning, compliance reporting, enrollment management, resource management, institutional effectiveness, student outcomes assessment, and program evaluation. The course is designed: 1) To give students a foundation in the concepts, methodologies, research practices, and information systems that support campus decision making. 2) To examine the diversity of the institutional research profession, including office organization and staffing, and functions/activities. 3) To acquaint students with the major IR topics including overview of National Data sets, Planning and Budgeting, Enrollment Management and enrollment

forecasting, Faculty Studies and Instructional Analysis, Institutional Effectiveness and accreditation, Educational Effectiveness and Student Outcomes Assessment.4) To give students experience in using SPSS software, making Power Point presentations, and effective reporting on selected IR topics. During this course, the classroom and work experiences are aimed at understanding the readings, obtaining hands-on experience in analyzing data, and developing reporting skills for the purposes of institutional research. The course serves as a bridge to the other courses that will be offered subsequently in the Institutional Research Certificate program. This course introduces main topics, concepts and processes that are central to the practice of institutional research. It gives an overview of sources used in institutional research and the methods employed. Most importantly, this course aims at introducing students to a variety of reporting strategies and developing report writing skills. Pre-requisite: Working knowledge of basic statistics.

HIED 806: Teaching and Learning in Higher Education

3 Credits

This course gives students an overview of the intricacies of college teaching and learning. There is both an art and a science to teaching and by exploring pedagogical issues and approaches, students will leave this class with a solid instructional foundation. They will have opportunities to learn independently, collaboratively, and reflectively as they question assumptions by reviewing current educational research, and practice instructional strategies. While teaching experience is a plus, it is not required. Being a learner, however, is not optional.

HIED 807: Foundations of Academic Advising

3 Credits

An overview of the academic advising profession and the role of academic advising in the collegiate setting. HI ED 807 Foundations of Academic Advising (3) This course will provide students with an overview of the academic advising profession and the role of academic advising in the collegiate setting. Topics include the history of academic advising; philosophical and theoretical perspectives; models of academic advising; ethical and legal foundations; emerging issues; scholarship; assessment and evaluation; the advising of diverse and unique populations of students; the use of technology in academic advising; the role of academic advising in retention, graduation rates, and student success; the professional development of academic advisers; the future of academic advising nationally and internationally; and the professional preparation necessary to enter the field of academic advising.

HIED 808: Pro-Seminar in U.S. Higher Education

3 Credits

This course is an overview of graduate study, professional careers, and professionalism in higher education. There are no prerequisites for the course and the course content assumes no prior knowledge of higher education as a field of study or as a place of employment. Learners will be actively engaged in developing skills needed for success as a graduate student and as a professional in higher education or a related field. The goal of this course is to prepare students for success as graduate students in the study of higher education and to develop a career plan for self-direction and lifelong learning.

HIED 810: Planning and Resource Management in Higher Education

3 Credits

Strategic planning and resource management in higher education through institutional research. HI ED 810 Planning and Resource Management in Higher Education (3) This course provides students with a working knowledge of strategic planning models and budgeting structures and processes. Planning and budgeting skills are important components in institutional decision support, and this course provides students with tools and skills in environmental scanning, revenue forecasting, expenditure controls, and bench marking. Curricular goals: Upon completion, students will be able to:1) discuss, in an informed way, the history, evolution, theory and practice of strategic planning in higher education;2) appreciate contextual influences (such as organizational politics and culture, leadership, environmental constraints, and the like) on planning;3) apply data and decision-support tools that can support strategic planning and resource management;4) apply group process tools to enhance communication, consensus, and action;5) demonstrate a pragmatic ability to help integrate strategic planning with institutional research and organizational improvement in a college or university setting. HI ED 810 is designed for institutional research professionals, and the on-line learning experiences are aimed at applying the readings, obtaining hands-on experience in analyzing data, and developing reporting skills. Each Unit lists supplementary readings and weblinks where you can find additional information to explore the topic in greater depth. The methods of teaching and learning include Readings and Supplemental Resources, Professor's Notes, Discussion Forums, Drop Boxes, Collaborative Learning Opportunities in small groups, Individual Learning Opportunities or a personal project, and Essays or Papers. This course has an established start and end date and includes interaction with other students throughout the course. Pre-requisite: a working knowledge of basic applied statistics.

HIED 830: Designing Institutional Research Studies

3 Credits

Develop skills to design and execute IR studies using quantitative and qualitative research methods. HIED 830 Designing Institutional Research Studies (3) This course acquaints students with best practices and necessary skills in quantitative and qualitative research design including sampling and basic measurement issues, research methods, survey research, interviews, focus groups, and selecting appropriate statistical tools. Upon completion of this course, students will be able to: 1. Define and explain the following concepts/tools of social science research: The scientific method Theory and its role Constructs and variables Experimental designs Hypotheses and relations Ethical Principles and practices Survey designs and methods Sampling theory and designs Approaches to data collection Quasi-experimental designs Measurement reliability and validity Ex post facto designs Quantitative analytical designs Focus Groups & Interviews Qualitative analytical designs 2. Apply these concepts/tools in designing a study relating to education research or policy analysis; 3. Effectively critique and evaluate both the theoretical bases (if any) and methods of a journal article or report of a piece of research or policy analysis. This course has established start and end dates and includes interaction with other students throughout the course. Use of the course Web site is required (the central area for accessing class notes and postings, e-mail communication, ANGEL, downloading files). The course is structured around learning units, each roughly corresponding to one week of a Penn State semester. Learning units are self-contained and built around a single theme or topic. Each contains an introduction, objectives, reading assignments, professor's

content, and learning activities. While it is possible to accelerate or vary the reading and research schedule, the discussion components among peers should adhere roughly to the time frame (the week) within which each Unit is presented. As a pre-requisite for this course, students are expected to: * Know the definition of a "variable" and the distinctions among dependent, independent, and control variables. * Know basic descriptive statistics (e.g., mean, median, variance, standard deviation, percentage distributions), basic inferential statistics (chi-square test of association and goodness-of-fit test, t-tests, one-way analysis of variance, correlations); the concepts underlying ordinary least-squares (OLS) multiple regression and the basic multiple regression statistics (R^2 , R^2 -change, b-weights, and beta weights).

HIED 840: Assessing Student Outcomes & Evaluating Academic Programs

3 Credits

Academic program assessment/student outcomes in accountability and accreditation processes. HI ED 840 Assessing Student Outcomes & Evaluating Academic Programs (3) This course pulls together the many threads that add up to educational effectiveness: evaluating academic programs and curricula, assessing student learning outcomes, coping with accountability and performance reporting requirements, responding to the demands of both regional and disciplinary/vocational accreditation bodies. The course acquaints students with strategies and instruments for conducting outcomes studies of programs, students, and alumni alike. Assessment topics include studies of students' basic skills, general education, knowledge in the major, personal growth, and alumni outcomes. Thus, the course is designed for higher education professionals who seek to a fuller understanding of Student Outcomes Assessment, Program Evaluation, and Institutional Effectiveness. The on-line experiences are aimed at applying the readings, obtaining hands-on experience in analyzing data, and developing reporting skills. Each Unit lists supplementary readings and weblinks where you can find additional information to explore the topic in greater depth. The course has linkages to the other courses in the Institutional Research Certificate program. For example, the opening weeks of HI ED 840 expand upon some of the assessment and evaluation readings and materials covered in selected units of the Foundations course (HI ED 801). Both this assessment course and the course on Studying Students and Student Affairs (HI ED 802) draw upon and discuss relevant literature and theories of student outcomes. Persistence models and theories referred to in these courses are relevant also to Enrollment Management and Forecasting (HI ED 860). The Research Design course (HI ED 830), with its emphasis on measurement issues and survey research, provides an analytical foundation for all these other IR courses. HI ED 840 summarizes the best of what we know about assessing student outcomes. Few topics are more complicated than outcomes assessment. The needs of students and the areas of their learning vary highly among institutions and degree programs. Students are diverse and the dimensions of the learning processes in American Higher Education are extremely complex. Likewise, assessing student performance is complex and hence difficult to summarize. Moreover, before we travel into the real content of assessment, we need to place our journey within a context, and within an environment that is heavily shaping what we do. Thus, before we focus on evaluation academic programs and assessing student outcomes, we will examine accountability, accreditation, and performance reporting. In recent years, evidence of student outcomes has become one of the key indicators of institutional effectiveness, especially as it is viewed by accrediting associations and many state higher education governing boards.

HIED 841: Research and Assessment in Student Affairs

3 Credits

Accreditation bodies, state legislatures, critics, and the public at large continue to challenge colleges and universities to demonstrate what and how students are actually learning. Further, student affairs departments are being scrutinized-both internally and externally-regarding the importance, relationship, and effectiveness of their initiatives for student learning and persistence. This course suggests that research, program evaluation, and assessment are critical skills for student affairs practitioners to develop in responding to such concerns and in order to undertake and accomplish their efforts with excellence. More specifically, this course will help students to contextualize and evaluate student affairs programs with an eye towards effectiveness and improvement.

HIED 842: Administrative Leadership in Higher Education

3 Credits

This course gives students an overview of administrative leadership within higher education institutions. Students learn about organizational structure, governance, leadership, decision-making, internal and external constituencies, culture, resources, and organizational change. Brief discussions of key organizational theories are included but the course primarily focuses on administrative practice.

HIED 843: Foundations of Student Affairs

3 Credits

This course examines the nature and purpose of the student affairs profession, its functions, and how they can be effectively managed, coordinated, and integrated as part of student learning in American institutions. It also explores institutional strategies for organizing, staffing, and funding the large portfolio of programs, services, and facilities designed to facilitate student learning and development at different types of institutions. Complementing material learned in other HIED courses, this course will explore the practical use of student development theory, student learning assessment, and organizational theory in student affairs.

HIED 844: Diversity and Inclusion in Higher Education

3 Credits

Explores diverse student populations, the value university communities place on these differences, and development of skills to assist these populations.

HIED 846: College Students and Their Success

3 Credits

Numerous scholars, over many years, have explored a wide array of topics about college students; their preparation for college, their generalized and particularized characteristics, their behaviors in college, their attitudes about social issues, their relative success in achieving learning outcomes, their engagement (or lack thereof) with various components of the collegiate learning experience, their persistence, and the list goes on and on. This course probes a few of the many relevant avenues of inquiry that comprise ongoing efforts to study college students. More specifically, we will utilize Alexander Astin's Inputs-Environments-Outcomes (IEO) model (1991) as a useful way to organize

an analysis of college students, perhaps with slightly more emphasis placed on the Inputs component of Astin's model.

HIED 849: Legal Issues in Higher Education

3 Credits

This course is an overview of the legal standards arising in higher education, including institutional legal obligations, the rights and responsibilities of faculty, staff, and students, and the legal and regulatory roles of states and the federal government. The course is intended to serve the needs of students with varied professional and academic interests related to higher education who would benefit from a greater understanding of the legal forces that affect colleges and universities.

HIED 850: Analyzing Faculty Workload, Performance, and Compensation

3 Credits

Develop research skills to analyze faculty workload and performance in teaching, research, outreach, and compensation. HIED 850 Analyzing Faculty Workload, Performance, and Compensation (3) This course provides researchers with an overview of faculty issues with the analytical skills and tools associated with analyzing faculty workload and performance in teaching, scholarship, and outreach. The course is designed for those entering careers in institutional research and planning, particularly those whose work supports the Provost, as well as for those whose work is related to faculty analysis and reporting in other higher education settings. Topics include an overview of needed local and existing national databases, measuring faculty workload, evaluating faculty research productivity, using student ratings of instruction, providing support for academic program reviews, conducting salary studies, addressing issues of equity/diversity, and assessing faculty satisfaction, turnover, and flow. Curricular goals: Upon completion of this course, students will be able to: - Understand concepts, methodologies, research practices, and information systems that support academic decision making in the Provost's Office. - Use NSOPF, NSF, IPEDS, HERI, and other national databases that collect faculty information. - Develop appropriate metrics to gauge faculty work in instruction, research, and service. - Understand the diversity of academic work-life and labor market issues at national and institutional levels. - Carryout at a basic level the major Institutional Research faculty-related analyses, including instructional analysis, research productivity, benchmarking, salary equity, and turnover projections. - Utilize SPSS software, make power-point presentations, and produce effective reports related to faculty issues. This course has established start and end dates and includes interaction with others throughout the course. The course is structured around learning units, each roughly corresponding to one week of a Penn State semester. Learning units are self-contained and built around a single theme or topic. Each contains an introduction, objectives, reading assignments, professor's content, and learning activities. While it is possible to accelerate or vary the reading and research schedule, the discussion components among peers should adhere roughly to the time frame (the week) within which each Unit is presented. Pre-requisite: Working knowledge of intermediate statistics such as OLS regression.

HIED 860: Enrollment Management

3 Credits

This course gives students an overview of key components of strategic enrollment management. The course is divided into three parts. The first part, which contains the initial three lessons, presents core themes that

permeate the class while also familiarizing students with the field of enrollment management. The second part addresses the core activities associated within enrollment management: recruitment, admissions, financial aid, and retention. The final part of the course focuses on current trends in enrollment management and on topics of interest to the students.

HIED 897: Special Topics

1-9 Credits/Maximum of 18

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

History (HIST)

HIST 500: Theory, Method and the Practice of History

3 Credits

An examination of the theory and methodologies of the historical discipline and classic works of historiography.

HIST 510: Early Modern Environmental History

3 Credits

The purpose of this course is to explore the place of the natural environment in the late medieval and early modern world. It does so by revisiting classic episodes in world history, from the Mongol conquests in the thirteenth century until the volcanic eruptions of Laki (1783) and Tambora (1815), and reinterpreting them through the lens of environmental history. Topics considered include climate change, plague epidemics, wetland drainage, urbanization, malaria, forestry, colonization, and the commodification of nature. Horses, mosquitoes, and rats will come under the spotlight as active participants in the great transformations of world history. Central to our inquiry throughout the semester is the perennial problem of historical agency; how humanity's freedom to think and act interacts with the limits that nature imposes. Along the way, students will be given an overview of the concepts, methods, and sources of environmental history.

HIST 511: Topics in Medieval Britain

3 Credits/Maximum of 6

Readings and research in major themes of the history of medieval Britain.

HIST 512: Church and State in Medieval Europe

3 Credits

This course provides students with an overview of the political developments of church and secular government in medieval Europe.

HIST 513: Gender in the Early Modern World

3 Credits

This graduate seminar explores the major scholarly developments in the study of women's history, masculinity, and gendered representations in early modern Europe (1400-1800) and several colonial areas. Topics covered include the family, women's health, work, sodomy, witchcraft and the reformation, honor, slavery, missions, monasticism, and the Inquisition. Through weekly discussions, students will become

familiarized with the various methodological and archival trends in recent and more classic scholarship.

HIST 514: Global History 1300-1800: Empires, Economy, and Civilizations

3 Credits

This course covers the basic historical information, historiographical orientation, and theoretical discussions of the major problems of global history between the end of the Middle Ages and the beginning of the modern world. It covers the history of Europe, Asia, Africa, the Americas, as well as Oceania in a thematic and chronological manner.

HIST 515: Early Modern Europe

3-6 Credits

A graduate seminar examining selected topics in early modern European history through readings, discussions, and research papers.

HIST 516: US Women's and Gender History

3 Credits

A critical analysis of gender and theories of gender in selected American historical contexts.

Cross-listed with: WMNST 516

HIST 522: History and Social Theory

3 Credits

The course examines the possible use of social theory by historians and explores how theory could inform historical writing. It provides an outline of canonical theoretical perspectives on modernity, class, race, gender, nationalism, totalitarianism, and the public sphere. Students will learn to navigate between theoretical perspectives that differ in the answers they give to fundamental questions, along several continuums: from emphasizing material processes as shaping human history to prioritizing the power of ideas; from accrediting the autonomous free will of humans to ascribing more influence to constraints set by social structures; from considering human history a sphere of endless conflicts to seeing it as a site where consensus and harmony are gradually built; from recognition of the existence of objective social reality to the acceptance of merely various subjective points of view; from the explicit ambition to make theory a tool for advancing certain political goals to an ambition to be politically neutral. Various scholars provide different answers to these questions. While analyzing them the course addresses, in particular, the following questions: What are some of the strengths and weaknesses in each of these positions? How are particular ways of theoretical thinking related to the specific social positions and biographies of the theorists? How have the foundations of each of these views changed over time?

HIST 523: The History of Colonialism and Mass Death

3 Credits

Over 100 million people were victims of mass killings, including genocide, in the 20th century. And yet, episodes like the Holocaust were not the first instances of state-sponsored mass death; on the contrary, mass killings and mass death have been a distinguishing feature of colonialism and its aftermaths for at least the last five centuries. How and why did these acts and processes occur? What forces caused humans to kill others on a massive scale? How have slower or less sudden processes-like death via slavery or disease-been reinterpreted and

debated as foundational to genocide? What do these episodes reveal about the nature of race, religion, colonialism, technology, and modernity? HIST 523 is a graduate seminar that gives students an overview of the key literatures, methodologies, and debates in the historical literature on colonialism and mass killings, from genocide to epidemiological collapse, from the fifteenth century to the present. Its broad temporal framing and comparative framework reflects debates over the place of violence in European expansion in the Americas, Africa, and Asia, while also allowing for more subsequent, more local mass killings in places where colonization retreated. Before delving into specific historical examples, we will explore definitions of colonialism, mass death, and genocide. The course is then organized chronologically and examines episodes across a broad geographical spectrum, including early modern France, the early Columbian New World, the 19th century American West, 19th century Australia, Congo and Namibia during the "Scramble for Africa," East Asia in the early-mid 20th century, 1980s Guatemala, and the Darfur Genocide of the early 2000s. It familiarizes students with the re-reading of colonial and post-colonial histories since the coining of the term 'genocide' in 1944, by Raphael Lemkin, and the debates that the application of the term outside of Europe, outside of the Holocaust, have engendered. Students will be prepared to: teach on the history of mass death, mass killings, and genocide outside of Europe; more efficiently read and review academic texts; and find and interpret primary sources. This course is open to students across departments, and highly recommended for students minoring in Holocaust and Genocide Studies.

HIST 524: Deviance, Crime and Madness in Modern Europe

3 Credits

Historiography of deviance, crime, and madness in Europe from the late-18th century to the present. HIST 524 Deviance, Crime and Madness in Modern Europe (3) Historians and social scientists have shown that societies have persistently established certain standards and ideals for human conduct and being. At the same time, the natural variation in human phenotypes has meant that individual, groups, and institutions within these societies have been faced with those deviating from these norms. The deviations may sometimes present themselves physically (e.g., in the form of a somatic lesion or disability), intrapersonally (e.g., in eccentric thinking or affect), or interpersonally (e.g., in criminal or anti-social conduct). As historians, anthropologists, and other have demonstrated, while there are noteworthy continuities in how these deviations have often been manifested (e.g., seizures accompanying epilepsy), there have been considerable differences across time and place in how deviance has been expressed, perceived, understood, and handled. This seminar examines this constellation of problems as they have emerged in Europe since the 18th century. Posing, as they do, complex human problems, the historical study of deviance, crime, and madness requires paying attention to the scholarly contributions of multiple disciplines beyond the field of history. Thus, the course will attend to both social theory and historiography. Each week, readings from social theory will be paired with a historical work, in order to bring broad theoretical analysis and empirical disciplinary research more deliberately into conversation with one another. Some examples of the course readings include Emile Durkheim's *On Suicide*, Erving Goffman's *Stigma: Notes on the Management of a Spoiled Identity*, Janet Oppenheim's "Shattered Nerves: Doctors, Patients, and Depression in Victorian England," Norbert Elias' *The Civilizing Process*, Reviel Netz's *Barbed Wire: An Ecology of Modernity*, and Jan Gross' *Neighbors: The Destruction of the Jewish Community in Jedwabne, Poland*. Weekly topics will center on key social processes and prominent conceptual frameworks: social control, self-control, marginalization, pathologization, criminalization and de-criminalization, representation, punishment, extermination, and

enhancement. Students will be required to write an interdisciplinary research paper (i.e., a paper accessible to multiple scholarly audiences), calling on both theoretical and empirical scholarship from various disciplines. The course will culminate in a seminar conference in which students will present their research and field questions and comments.

HIST 525: Imperial Borderlands in Modern Europe

3 Credits

This course provides students with an overview of the processes of constructing borders in a variety of forms, ethnic, religious, trade, and linguistic, in a European imperial context. HIST 525 Imperial Borderlands in Modern Europe (3) This course exposes students to the latest developments in colonial studies and new paradigms for considering European imperial history in terms of its borderlands. Using the methodological tools applied in recent years to the history of Western colonial empires, this course expands the scope of European history to encompass the complex interaction between the conquered peoples and their rulers by broadening imperial history to include the study of ethnic and religious differences that emerged from the European encounter with peoples whose cultures differed profoundly from their own. In particular, the material covered in this course will build an awareness among students of the role of states, and especially imperial states, in confronting the polyethnic/multinational character of populations they sought to rule. The theoretical and historiographical works assigned will focus on how imperial European states crafted or erased cultural differences and how borderlands posed particular challenges in these endeavors. Building on these insights, students will gain an awareness of imperial policies and conceptions of colonial rule and of the impact of imperial domination on colonial peoples. Students will learn to recognize and identify the means by which Imperial rule brought irreversible changes to the way of life of the borderlands peoples, who adapted to and resisted imperial rule by a variety of means that they had at hand. Such an approach will yield an awareness of the methods by which historians formulate questions, choose sources, use theory to interpret the material they collect, and the variety of rhetorical and other means available to historians to present findings. Students will conduct their own analyses of scholarship by reflecting on the assigned readings and presenting their thoughts and evaluations in the form of weekly critiques and a final paper. This will be invaluable in helping students to acquire the necessary methodological and theoretical tools to formulate questions for their own research projects. This course fulfills the requirement of a topical graduate course in History. It is open to students within and outside of the History Department.

HIST 527: Societies, Citizens, and Violence in Modern Europe

3 Credits

The social and cultural history of warfare in modern Europe, with specific emphasis on the First and Second World Wars.

HIST 530: History of Science in the Early Modern World

3 Credits

This course exposes students to the current state of scholarship from the standpoint of historical, legal, sociological, and literary analyses of science in the early modern period. The inadequacy of long-accepted notions of "science" and "modernization" to describe the rapid changes of scientific thought in the early modern era require students to assess the specific value given to such notions by the state, religion, and society in specific cultural and historical contexts. The seminar will also explore

the reconceptualization of society and nature in the early modern period and the way in which discoveries in natural philosophy inspired those changes. The exchanges between European and non-European centers of authority during the early modern period helped to shape many of these disputes and scholars' current interpretive frameworks. In particular, we will challenge triumphal narratives of the Scientific Revolution by examining the ways in which geography and local context affected ideas about the natural world, the role of gender in knowledge-making, and how non-elite and artisanal practices also contributed to the creation of early science. A focus throughout the course will be on how the exchanges between European and non-European intellectual communities shaped contemporary understanding of the natural world. The seminar is intended for graduate students in history and related fields who are preparing for the field in Early Modern studies. The seminar is intended for graduate students in history and related fields who are preparing a field in early modern studies.

HIST 531: Religion and State-making in the Early Modern World

3 Credits

This course is a research seminar covering the historiography of early modern Europe, the Ottoman Empire, Mughal India, Warring-State and early Tokugawa Japan, Choson Korea, and the history of Ming and Qing China with a focus on the interaction between religious and political history.

HIST 533: Studies in Russian and Soviet History

3-6 Credits

No description.

HIST 535: History of the Body

3 Credits

This course provides students with an overview of the contribution of intellectual and cultural historians to the field of "body history." HIST 535 History of the Body (3) This course exposes students to the contribution of intellectual and cultural historians to the field of "body history." Ranging from the late medieval to early twentieth century, the course will focus attention on the early modern period. Inspired by the writings of Ernst Kantorowicz, Norbert Elias, Michel Foucault, Pierre Bourdieu, and Judith Butler, among others, historians have demonstrated that bodies are not exempt from social, cultural, or ideological regimes of power. As a metaphor for the body politic or an instrument of power, the corporeal order is shown to have physical, social, symbolic, and political effects. As historians continue to demonstrate, the body has a history: which involves health, sickness and food, gestures and movement, sartorial codes and sumptuary regulations, gender taboos and sexual prohibitions. Studies of the body demand a multidisciplinary perspective. Thus, this course explores how historians have drawn upon visual as well as textual sources, and crossed disciplinary boundaries in order to better appreciate the entire range of bodily representations in the past.

HIST 537: Early Modern Atlantic World

3 Credits

This seminar provides an overview of early modern Atlantic history from the late fifteenth to the early nineteenth centuries. Like other seminars in the Early Modern Global curriculum, it builds on the knowledge and skills acquired in the core seminars. HIST 537 offers an overview of Atlantic history, an orientation to important research questions and problems

in the field, and methodological training in the critical use of primary sources and its relationship to the important multidisciplinary concepts underlying historical research in the Atlantic field.

HIST 539: Topics in Military History

3 Credits/Maximum of 9

Studies in the history of wars and of the political, social, economic, diplomatic, and theoretical foundations of warfare.

HIST 540: Native American History

3 Credits

Surveying Native American history from the pre-colonial era to the present, this course examines key historical events, including: Indigenous civilizations before colonialism; the invasion of North America by Europeans; colonial epidemics; the Indian slave trade; the Pueblo Revolt; the Seven Years' War; the development and impacts of U.S. Indian policy; Indigenous sovereignty. Methodologically, this course exposes students to a range of historical subfields, such as social history, cultural history, political history, military history, and gender history. Additionally, History 539 gives students an overview of ethnohistory, an interdisciplinary field that draws on techniques and sources from History and Anthropology. By studying ethnohistory, historians will become better acquainted with cultural anthropology and archaeology. This seminar introduces students to major questions, themes, and problems in Native American history. These include: How can we study pre-colonial Indigenous history? What impact did colonization have on the Americas? How did Indians, Europeans, and Africans attempt to navigate cultural differences? How did the enslavement of Indigenous peoples and Africans impact race in North America? How do Native-centered histories transform our understanding of the American past?

HIST 541: War in the Early Modern and Modern World

3 Credits

The study of the causes, conduct, and political, social, diplomatic, cultural, and economic consequences of war from 1500 to the present. HIST 541 War in the Early Modern and Modern World (3) This course offers an introduction to the complexity of war in the early modern (1400-1850) and modern world (1850 to the present). Since war has been experienced across the entire world, the course will draw readings and examples from North and South America, Europe, Asia, and Africa. It brings together the two major approaches to the study of war, both the traditional emphasis on the battlefield and the more recent consideration of both the battlefield and the political, social, economic, and cultural homefronts. Specifically, this course considers the various methodologies that have shaped the ways in which historians have asked and answered such fundamental questions as how and why wars start, have been averted, and ended. The study of military theory provides the intellectual framework that shaped the study and conduct of war at specific periods of history and in specific cultural context. The evolution of a nation's military theory over time reflects the impact of changes in technology, the changing social composition of its armed forces, the strength of the economic support the national government will supply, and much more. Thus, this course considers issues relevant to armies (technology, soldier experience in battle), to the government (laws of war, revolutions in military affairs, military doctrine, war and national identity), and to the people (issues relating to race, class, and gender; antiwar activism,

popular literature) for a fuller understanding of the overarching impact of war in the modern and early modern world.

HIST 542: American Borderlands

3 Credits

This course provides graduate students with an introduction to the field of American borderlands studies. It devotes a great deal of coverage to the most important of the nation's international frontiers, the U.S.-Mexico border, by detailing the various positions of Native Americans, Anglos, Asians, and Mexicans as they struggled over competing visions of an American future. But the course also attends to other major American frontiers, including the Atlantic littoral, the Canadian border, and the Pacific rim; it also examines all these in international context. In order to get a broad survey of the state of the field, we will examine how cross-cultural encounters shaped policy, changed the landscape, and heightened racial tensions. Using a variety of texts-documentary and feature films, magazine and newspaper articles, travelers' accounts, academic monographs and articles, and popular literature-we will explore a range of topics: territorial expansion, Native dispossession, racial formation and anxiety, Mexican, Asian, and Canadian migration and labor, and cultural change and negotiation. The course will begin with a close examination of the political, economic, and military conflicts that defined America's eastern, southern, northern, and western boundaries and then follow a series of selected historical events that led up to the current political and cultural debates that continue in the borderlands today. Drawing on these items, we will ultimately reflect on how past and present collide in all the nation's borderlands, shaping the United States in countless ways.

HIST 543: United States History to 1877

3 Credits/Maximum of 6

Primarily a reading seminar, this course focuses on United States history from the 17th century to 1877, emphasizing the profound ways that the British American colonies and then the United States changed through numerous social, cultural, economic, and political revolutions. In particular, the course investigates transitions from the colonial period through the road to the Revolution, the Early National period, the Jacksonian Era, the sectional conflict, and the Civil War and Reconstruction. Students will examine the growth and impact of the institution of slavery; territorial expansion; cross-cultural encounters; social, cultural, economic, and political revolutions; the consolidation of capitalism; and the impact of reform movements on the colonies and nation.

HIST 544: Topics in the Civil War and Reconstruction

3 Credits/Maximum of 6

Background and impact of the Civil War and the two succeeding decades, with emphasis on historiography and selected topics.

HIST 545: United States History, 1877 to Present

3 Credits

Primarily a reading seminar, this course focuses on United States history from 1877 to the present, emphasizing the profound ways the nation changed socially, culturally, economically, and politically since the late nineteenth century. In particular, the course investigates and builds an awareness of the transition from the Gilded Age through the two world wars, and onward through the social protest and civil

rights movements of the 1960s. This seminar will address a variety of topics: industrialization; evolving ideas about individual rights; the role of government in social and economic affairs; the emergence of the nation as an economic and military power; as well as social and labor movements. On a methodological level, the seminar will expose graduate students to a variety of interdisciplinary approaches and subfields of history, ranging from political, economic, social, ethnic, religious, cultural, and environmental history.

HIST 546: The Rise and Fall of Modern America, 1919 to the present

3 Credits/Maximum of 6

Readings and research in major themes of the history of the United States in the twentieth century.

HIST 547: Slavery in the Americas

3 Credits

Slavery in South America, the Caribbean, and North America from 16th century European colonization through the 19th century abolition movement. HIST 547 Slavery in the Americas (3) This course provides a broad exploration of slavery in the Americas from the beginning of European colonization to abolition. From the sixteenth century to the nineteenth century, Spanish, Portuguese, British, and French colonists in the Americas created the largest slave societies the world has ever known. Slaves in the New World produced tropical commodities such as sugar, tobacco, cotton, and coffee that, in turn, contributed to the foundation of capitalist and consumer societies in the Atlantic world. The staple crops produced by slaves were among the first goods to transform elite luxuries into common necessities. The Age of Revolution was a watershed in the history of slavery in the Americas, transforming the terms of struggle between slaves and slaveholders, of debate about slavery, of the ideology of slavery. While the Age of Revolution catalyzed a century-long process of abolition, it also began a new period in the expansion of slavery. Slaveholders developed new policies, practices, and doctrines to reconcile slavery and liberalism. The adoption of modern technology and industrial techniques of production resulted in dramatic increases in the productivity and exploitation of slaves, as well as the wealth and power of slaveholders. The simultaneous growth of slavery and antislavery heightened political divisions over slavery and made its destruction a protracted struggle marked by slave rebellion and civil war as well as landmark acts of state. This course investigates the origins of slavery, race, and abolitionism; transformations in plantation production, the culture of Africans in the Americas, and the ideologies of slavery; and the relationships among slavery, liberalism, capitalism, and modernity. Students will apply a range of concepts from the human sciences, such as creolization, ideology, and human geography, to major problems in the history of slavery.

HIST 548: Space and Place in American History

3 Credits

This course offers a survey of American history from roughly the fifteenth to twentieth centuries. Students will read and discuss studies employing the lenses of physical space and place to examine the changes in the American landscape over time. They will learn to read the built environment as an historical text, assess how changes in landscape and spatial practice reveal larger shifts in social and economic structures, and identify the multiple practices of spatial arrangement that existed among diverse groups who came to make up the United States. They will be encouraged to recognize, identify, and apply the social scientific

theories of "the spatial turn" and the tools of spatial analysis to place. At the conclusion of the course, students will come to recognize the way analysis of place can reveal the values and power relations in society. They will articulate the importance of physical space in shaping social interactions and how that has changed over time, while also achieving a better understanding of the diverse characteristics of peoples, societies, and institutions in U.S. history.

HIST 551: The African American Freedom Struggle

3 Credits

This seminar provides students with an overview of important topics and debates related to the African American Freedom Struggle from Reconstruction to the present. The course is organized chronologically and thematically to highlight the changing and distinctive concerns related to African Americans' efforts to secure the rights and benefits of American citizenship. Special attention is given to the ways in which high politics intersect with grassroots actions. The course considers African American mobilization throughout the entire country and does not simply address the more familiar southern post-WWII struggle. Not only will students gain a critical understanding of some central debates in this field, but also, they will begin to think about how they might teach this material to undergraduates.

HIST 552: Late Modern America Society, Culture, and Politics 1975-2008

3 Credits

This course considers the political, cultural and social history of the United States from 1975 to the present.

HIST 553: American Environmental History

3 Credits

This course offers a survey of the history of the place that became the United States through the lens of the environment. Through attention to changing ecologies, conflicting resource-use regimes, differing ideas about what nature is and should be for, students will come to understand the many ways in which natural systems have shaped and been shaped by people in North America over the past five centuries.

HIST 556: American Social and Cultural History

3 Credits

Surveying Social and Cultural History in the 19th and 20th centuries in the United States, this course examines key themes and topics in the history of the field, including: race, class, gender, sexuality, labor, migration, citizenship, incarceration, and environment. This seminar gives students an overview of major questions and problems in American Social and Cultural History such as What is culture? How does society produce culture? What is the relationship between culture and politics? How do we write history from the bottom up? How do our methods constrain what histories we can tell? Methodologically, this course exposes students to a range of theories and subfields including political history, gender history, history of capitalism, labor history, urban history, and legal history. Additionally this seminar examines journalistic historical writing, biographies, and opinion editorials in order to examine the multiple forms history writing can take.

HIST 557: The History of the Modern Middle East

3 Credits

This course introduces graduate students to key historiographical and methodological literatures and debates in the field of modern Middle Eastern history. Drawing on a variety of historical approaches and methods from related disciplines, we analyze the transformation of the Middle East in the modern era as part of broader global processes. The rise of capitalism and the incorporation of the Middle East into the world economy led to wide-ranging transformations in agriculture, urbanization, the creation of new social classes, and migration within and to the region. The expansion of imperial, colonial, and national states occurred congruent with the emergence of mass politics, new technologies, and new public spaces. All of the above developments contributed to changing intercommunal relations, new gender roles, and a reassessment of the role of religion in political and social life. Graduate students will thus acquire deep knowledge about the history of the region while at the same time developing comparative skills and a broader understanding of the Middle East within world history.

HIST 558: Colonialism and Nationalism in the Middle East

3 Credits

This course provides a thorough grounding in the relationship between colonialism and nationalism in the Middle East, as well as in the emergence of modern nation-states and national identities. Topics will include but are not limited to: Visions of Middle Eastern modernities and the role of colonialism in shaping them; the place of religion and secularization as sites of colonial hegemony or national resistance; popular culture as contested terrain in the colonial era; the various ways the colonial encounter shaped social norms and patterns related to gender and sexuality; and the nature and effects of colonial violence.

HIST 559: Migrants and Refugees in the Middle East and North Africa

3 Credits

This course investigates the history of mass movement within and out of the Middle East, the Balkans, and North Africa from the late nineteenth century to the present day. We will examine multiple manifestations of such movement: emigration and reverse emigration, forced population transfers and exchanges, the making of refugee communities and their movements around the region, and the influence of diaspora communities on political, social, and economic movements in the homeland. As well as investigating the role migrants and refugees have had in the making of the modern Middle East, this course will give students the opportunity to engage with major issues surrounding diaspora, transnationalism, and citizenship, as well as broad historical questions of identity and belonging.

HIST 561: Ottoman Empire

3 Credits

This course offers an overview of the historiography of the Ottoman Empire. The weekly readings will include a combination of classic and recent scholarship and will acquaint students with some of the historiographical questions, research methods, and theoretical framings that have shaped the field since the early twentieth century. Students will acquire the foundational knowledge to teach courses on the Ottoman Empire or conduct original research. The course will appeal to students of

early modern history, Middle East history, and world history. Knowledge of a Middle Eastern language is not required.

HIST 562: Women, Gender, and Sexuality in the Middle East

3 Credits

The course provides an in-depth examination of key topics in recent research on the study of women, gender, and sexuality in the Middle East and an investigation of changes in the field. The course promotes theoretical, analytical, and methodological approaches that redirect understanding and research away from a legacy of essentializing norms identified with orientalism and colonialism. The course begins with a discussion of how and why women, gender, and sexuality of the Middle East became a distinct field and the challenges imposed by its origins in an era of colonial empires and missionary activism. The course examines pioneering studies in women's history and gender and sexuality and investigates some of the most recent scholarship thematically. Readings include monographs and articles from an array of locations and perspectives to provide a view of the complexity of topics and of regional, social, economic, racial/ethnic diversity, and to develop a foundation for comparative analysis. Topics include but are not limited to women, gender, orientalism, and Islam; women, gender, sexuality, and social disruption; women, gender, and sexuality in literature, art, and popular culture, contemporary feminisms and queer studies.

HIST 564: Islamic Law and Society in Historical Perspective

3 Credits

The course provides an in-depth examination of key topics in recent research on the study of Islamic jurisprudence (fiqh) and theory (usul) and an investigation of changes in the field. This class also offers a thorough examination of two or three topics within Islamic law with an emphasis on their development in recent history. Topics will be selected in consultation with students, and they will be approached from various disciplinary perspectives, including literary, documentary, and anthropological approaches. They should be of broad interest and could include subjects within family law, international relations, ritual, colonialism, democratization, and so forth. Readings include monographs and articles from an array of locations and perspectives to provide a view of the complexity of topics and of regional, social, economic, racial/ethnic diversity, and to develop a foundation for comparative analysis. Reading knowledge of Arabic is helpful but not required.

HIST 565: Palestine/Israel

3 Credits

This course provides a thorough grounding in the state of the field of the history of Palestine/Israel. It examines the encounter between Palestinians and Israelis from a perspective that questions our ability to understand them separately and it emphasizes interdependency between the Israeli-Palestinian conflict and internal tension within Palestinian and Israeli societies. Topics will include but are not limited to: Palestine/Israel as case of settler-colonialism, the place of religion in defining national identities and boundaries, intra-ethnic divides, competing discourses of citizenship, the fragile status of Palestinian citizens and non-citizens under the Israeli control system, struggles over collective memory, and the place of gender and sexuality in the conflict. The course emphasizes the intersection of politics and culture, demonstrating the political relevance of cultural fields such as music, cinema, and sports.

HIST 567: Revolution and Counter-revolution in Modern Latin America

3 Credits

Latin American colonial history was defined by exploitation for profit; the efficiency of state control over Indigenous and Afro-descendant populations established economic profit or loss. In the face of independence, abolition, and widespread immigration, racial hierarchy and exploitation continued to shape modern Latin America, but often under a fictive constitutional promise of equality, citizenship, and democracy. In the nineteenth century much of Latin America experienced the rise of caudillos, military strong men, and dictators who often rule through a limited or truncated form of democracy but come to represent the interests of the political, industrial, and landed elite who consolidate their control over much of Latin America in the early twentieth century. In response to this control, we see a rise of popular revolution throughout twentieth century Latin America. Some succeed while others fail; they include national and regional movements, they are shaped by labor, agriculture, populism, democracy, nationalism, socialism, communism, and military uprising. We later see-often but not always in direct response-a conservative backlash in the form of military dictatorships, neo-colonial and neo-liberal economies, torture, disappearance, murder, and anti-communist fervor driven by Cold-War ideology. We will examine these events through various lenses: that of participants, through analysis of regional and national outcomes, and through the intervention of global powers. We will ask what social, political, and/or racial conditions led to revolutionary situations? How successful were revolutionary leaders at shaping policies, administrations, and nations? What did revolutionaries seek to accomplish and what were the outcomes of their reforms? Conversely, what did counterrevolutionaries seek to accomplish and what were the outcomes of their reforms? We cannot address every "revolution" or every conservative backlash that occurred in modern Latin America. By addressing these themes in Cuba, Mexico, Central America, Chile, Brazil, Argentina, and Uruguay, we will emphasize forms of revolution, nationalism, "bureaucratic-authoritarian" state formation, imperialism, agrarian reform, immigration, industrialization, labor movements, and citizenship.

HIST 568: Medicine, Science, and Technology in Latin American History

3 Credits

This graduate course explores the history of medicine, science, and technology in early modern Latin America and Iberia, integrating interdisciplinary approaches and local/global contexts. It is designed to give students an overview of some of the key historiographical debates and research in these fields for Latin America and Iberia, and to provide a basic familiarity with the forms that this field of historical/interdisciplinary inquiry has taken in recent years. Some of the themes that we will explore are the role of empire building in shaping medical, scientific, and technological knowledge; how "non-Western" (indigenous, African, Asian, and mixed race) healers, artisans, and scientists innovated, developed, and recreated their practices and societal roles under colonial rule; the historical development of public health in Latin America; and the interactions between global processes of Western knowledge production and local-level multi-ethnic Latin American knowledge production. This course will be of interest to those studying colonial Latin America, those who wish to understand the colonial legacies of issues important to modern Latin America research topics, those interested in the early modern era in a comparative and/or global perspective, and those who wish to prepare for the Latin America or Early Modern World fields of their comprehensive exams.

HIST 569: Colonial Latin American History

3 Credits

HIST 569 gives students an overview of key literatures, methodologies, and debates in the historiography of Latin America (the writing of Latin American history), from the 1490s to the Independence period (mostly, but by no means solely, the 1820s). Its primary focus is Spanish America and Portuguese Brazil, especially Iberian interactions with indigenous American and Africans/African-descended people. But some attention is given to all regions of the Americas and to roles played by British, French, and other colonizers. Chronologically, it is a prequel to HIST 570 (but not an official prerequisite). The course comprises five sections, each based on an historical sub-field and its historiography within the larger field: (1) the indigenous civilizations of the Americas and their responses to European invasion, including the shift from traditional Eurocentric Conquest narratives to the New Conquest History; (2) the political and economic institutions, as well as the culture, of Spanish and Portuguese colonization; (3) the changes and continuities in indigenous civilizations during the colonial centuries (usually termed "Ethnohistory," and explored more fully in HIST 571); (4) the history of trans-Atlantic slavery and the experience of African-descended peoples in Colonial Latin America; and (5) a sub-field that will vary according to instructor, examples being the history of science and medicine in the region, the history of gender and sexuality, and the history of religious change (or "the Spiritual Conquest").

HIST 570: Latin American History, 1800-Present

3 Credits

This seminar gives students an overview of central literatures and debates in the historiography of Latin America (the writing of Latin American history) and the Americas more broadly, from approximately 1800 to the present. Its framing reflects the chronology of mainland Spanish American Independence, but it reaches backwards and outwards as needed. It looks to prior Andean and Haitian bids for self-determination and subsequent exports and imports - of empire, capital, people commodities, science, and instruments of terror - to and from the United States and Africa. It connects those nodes by tracing continuities in political, social, and environmental relationships, and by identifying the ways that peoples in the region (in the Caribbean, Mexico and Central America, Colombia and the Andes, Brazil and the Southern Cone) have thought and acted their way out of colonialisms. Chief among the seminar's goals is the preparation of graduate students to teach post-1800 Latin American History to undergraduates. Students will develop a grasp of the field's key historiographical developments, and think about new ways to teach a subject that many - but not all - North American undergraduates meet with stereotypes. Graduate students of other historical geographies and from other disciplines are welcome too, given that it is also designed to survey approaches to thinking historically after 1800, to question assumptions that those methodologies make, and to address the politics of researching and writing a post-colonial history of a place that has always been "modern," where "Latin America" came into being as a means of anticipating questions crucial to past and present imperialisms, global histories, and politics

HIST 571: Latin American Ethnohistory

3 Credits

HIST 571 gives students an overview of key literatures, methodologies, and debates in the historiography of Latin American ethnohistory, from the fifteenth to the nineteenth centuries. "Ethnohistory" is defined here as the historical study of the indigenous peoples of the Americas. The

course comprises four sections, each based on an historical sub-field and its historiography: (1) the indigenous civilizations of the Americas in the pre-Contact and Contact periods, primarily fifteenth and sixteenth centuries, including but not necessarily limited to the civilizations of the Aztecs, Mayas, and Incas; (2) indigenous responses to European invasion, with particular attention to regions of Spanish and Portuguese activity - and including the historiographical development of the New Conquest History, with attention also given to regions where colonies were not established; (3) the indigenous experience of Spanish and Portuguese colonization, and indigenous contributions to new colonial-era societies, including changes and continuities in indigenous civilizations during the colonial centuries - and including the historiographical development of the New Philology); and (4) the indigenous experience of the long Independence period, taking the seminar to a point in the nineteenth century, as determined by the instructor.

HIST 572: Race and Nation in Modern Latin America

3 Credits

From initial colonial contact, Latin America represents a site of violent conquest by European colonizers over indigenous populations and exploitation of both African and indigenous labor; white control over black and brown bodies was at the very core of colonial economic success or failure. In turn, racial hierarchy and exploitation define both colonial and modern Latin American history. Our focus is not the overall study of race and slavery throughout Latin American history. Instead we will examine the role of race in Latin American nation-building following independence through the age of twentieth century nationalism. As the ideas of scientific racism swept Europe and the United States in the nineteenth century, the United States established economic, and at times military, dominance over much of Latin America from the neo-colonial period of the late nineteenth and early twentieth century. Increasingly, as cultural and economic ties were broken with the Iberian empires—even in the case of Spain's last American colonies, Cuba and Puerto Rico—Latin American elite sought modernity through trade with and cultural borrowing from the United States and Europe. In response to the scientific racist ideology that in the US led to segregation, Jim Crow, convict lease systems, lynching, and widespread disenfranchisement, Latin American elite consciously engaged these racist ideas as they granted or restricted non-white populations access to their rights as citizens. Nineteenth century luminaries such as Cuban revolutionary José Martí, Argentine journalist and politician Domingo Faustino Sarmiento, and even Venezuelan military and political leader Simón Bolívar had introduced radical ideas on race and citizenship. In the first half of the twentieth century Latin American intellectuals famously built on those ideas by embracing, renegotiating, and/or rejecting North American racist ideologies—often all within the same work—as they optimistically and proudly recognized and rehabilitated the place of the nonwhite, indigenous, mestizo, and mulatto populations into their national narratives. We will focus on three of the best known of these authors (Mexican José Vasconcelos, Cuban Fernando Ortiz, and Brazilian Gilberto Freyre) as well as scholarship that will help us contextualize their works, and allow us to better understand the broader theme of race in modern Latin America. The object here is to consider how the subject of race—in large part defined by the role of Afro-Latin Americans, the indigenous, mestizo, and mulattos—is situated in relation to broader considerations of nation, power, violence, and identity. The goal of the course is to lay the groundwork for an interdisciplinary understanding of modern Latin America and the modern black Atlantic: To consider the consequences of colonization, slavery, and the slave trade, both

historically and contemporarily, on modern intellectual formations and institutions.

HIST 573: Empire & Society Latin Amer

3 Credits

HIST 573 gives students an overview of key literatures, methodologies, and debates in the historiography of empire and society in Latin American history, fifteenth to nineteenth centuries. The course comprises five sections, each based on an historical sub-field and its historiography: (1) the empires and societies of the Americas in the pre-Contact and Contact periods, primarily that of the Maya, Aztecs, and Incas; (2) the culture and society of Spanish and Portuguese imperialism in Iberia and the Americas (3) the culture and society of the Spanish conquistadors, including roles played by indigenous and black conquistadors; (4) the impact on the Americas of Spanish and Portuguese imperialism in East Asia, and the cultural and social ramifications of trans-Pacific exchanges during the colonial centuries; and (5) the comparative history of imperialism in the Americas by other European powers, most notably the British, Dutch, and French, including the differing experiences of indigenous and African-descended peoples. The seminar will end at a nineteenth-century point determined by the instructor.

HIST 580: Early Modern Asia

3 Credits

This course offers a foundation in early modern Asia from roughly the fifteenth to mid-nineteenth centuries. Students will examine the constitution of centralized and bureaucratic empires, ideological movements, and practices associated with Confucianism, Daoism, Buddhism, Islam, and Hindu thought, and the formation of syncretic socio-cultural spheres in different parts of Asia. Through an exploration of key political, cultural, and intellectual developments in Asia, students will assess Asia's place in the global network of thought, commerce, and exchange. Central to this analysis is how such contact with overland and maritime cultures deeply affected mainstream Asian societies. By tracing such interactions, students will be encouraged to recognize, identify, and apply the roles of frontier and borderlands in the creation and reification of identity and culture in different parts of Asia. Through this multifaceted approach to Asian history, students will come to recognize the strategic role of Asia within the pan-Eurasian sphere of interactions while also achieve a better understanding of the diverse characteristics of Asian peoples, societies, and institutions in history.

HIST 581: Modern China

3 Credits

Primarily a reading seminar, this course focuses on Chinese history from the mid-nineteenth century to the present, emphasizing the profound ways that the Qing empire, Republican China, and then the People's Republic changed through numerous social, cultural, economic, and political revolutions. In particular, the course investigates transitions from the late imperial period through the Revolution, the Warlord period, the Nanjing Decade, Second World War, the Civil War, and the establishment of the socialist China. Students will examine the changing role of women in Chinese society to the changing relationship of humans to environment, as well as exploring the multiple approaches Chinese historians have taken to reading and presenting historical work, including economic, political, social, and cultural history; social, cultural, economic, and political revolutions; the consolidation of communism; and the

impact of successive political movements on China and the Chinese peoples.

HIST 582: Women and Gender in Modern Chinese History

3 Credits

Examines the historical literature on women and gender in late imperial and twentieth century China. HIST 582 Women and Gender in Modern Chinese History (3) The roles of women and men have undergone major shifts in late imperial and modern China, affecting all aspects of daily life. Just the titles used to describe feminine ideals give an indication of these shifts - from the "talented women" of the late imperial period to the "new women" and "modern girls" of the early twentieth century to the "iron ladies" of the Communist period to the "factory girls" of the new millennia. Masculine ideals, too, have shifted, from the literary scholar-official of late imperial China to the patriotic worker of the Mao years to the entrepreneurial party member of the late twentieth century. But beyond the ideals, the day-to-day lives of Chinese people have been fundamentally altered as well, changing the way people relate to family and to society. This course examines the historical literature on these shifts from the late imperial period to the present. Misperceptions and stereotypes about Chinese gender roles and, in particular, the status of women are widespread. In the past several decades, historians of China have sought to place our understanding of these topics on firmer historical ground by exploring topics from homosexuality and law in imperial China to widowhood and the imperial cult of female chastity to new marriage practices in post-economic reform village China and, in doing so, to undermine the "orientalism" that informed, for instance, investigations of footbinding and the "women's quarters." Through a wide range of readings, this course will introduce students to the major works and topics in the field of Chinese women's and gender history, including: women and family, women's legal history, gender and nationalism, "new women" (xin funü), gender and revolution, gender and demographics, gender and labor, women's liberation, and love and sexuality. Students will be expected to demonstrate their familiarity with the major themes and topics for Chinese women's and gender history through discussion and written work.

HIST 583: Rebellion, Revolution and Nation in China

3 Credits

A research seminar, this course focuses on rebellion and revolution in Chinese history from the mid-nineteenth century to the present. In particular, the course investigates not only the myriad forms of revolution experienced in China including the 1911 Revolution, the Warlord period, the Nanjing Decade, Second World War, the Civil War, and the Cultural Revolution, it seeks to see these through the lens of the political ideologies such as nationalism, anarchism, communism, and feminism. Students will examine the manner in which the tide of rising expectations predicated the social and economic motivations lingering in the more overt political demands. Understanding the dramatic shifts in Chinese culture as well as its relationship to global politics will shape much of the seminar's focus.

HIST 585: Asian Environmental History

3 Credits

This course provides a thorough grounding in the state of the field of environmental history in Asia, including East Asia, Southeast Asia, and South Asia. It will begin with an introduction to methods and trends in environmental history in general and Asian environmental history's place

within the larger field, followed by an overview of foundational works in the field. Students will come away with sufficient knowledge to teach courses in Asian environmental history or conduct original research. It will be of interest to students of Asian history, environmental studies, and the history of science. Knowledge of an Asian language is not required.

HIST 586: Modern Japan

3 Credits

This course provides students with an overview of the literature and themes in modern Japanese history. HIST 586 Modern Japan (3) This course explores multiple themes in Japanese history, with a focus on the politics of culture and changing perceptions of Japan's role in the world. There is a close focus on the interplay between domestic politics, foreign relations, and ideas. Through critical reading of major monographs and articles, students will hone their skills in argumentation and the use of evidence. Ideally, this course will stimulate ideas for research projects in other seminars, and it will present students with a variety of approaches to historical problems. Given the close relationship between China and Japan this course is strongly encouraged for those students studying Chinese history at the graduate level. Finally, this course will prepare students to teach a course in modern Japan at the undergraduate level.

HIST 587: Topics in Modern South Asian History

3 Credits/Maximum of 6

Research and readings in the history of South Asia since the late eighteenth century.

HIST 588: Ethnicity and Borderlands in China

3 Credits

A research seminar, this course examines Chinese history from a multi-ethnic perspective. Major topics to be covered include the theoretical development (and evolution) of the terms frontier and borderlands; ethnicity in the imperial period; the centrality of ethnicity in China's conceptualizations of itself; and ethnicity in the People's Republic of China. After successfully completing this course, students will be able to: to demonstrate their familiarity with the major themes and topics for Chinese imperial history and how it relates to the intertwined conceptualizations of ethnicity through discussion and written work. Students will have the option to use this course as a research seminar, conducting primary document research alongside their historiographic readings.

HIST 589: World History: Themes and Approaches

3 Credits

This course provides students with the thematic and theoretical foundation for the study and teaching of world history. HIST 589 World History: Themes and Approaches (3) This course will provide students with the thematic and theoretical foundation for the study and teaching of world history. Because world history is a crucial secondary field for historians, with increasing emphasis on it as a necessary "teaching field," this course seeks to equip students to teach world history at the undergraduate level. The course will be divided into five primary units, each of which will address a major theme in world history, such as the rise of civilizations, great land empires (particularly the Han Dynasty and the Roman Empire), the Silk Road, the spread of world religions, the Mongol invasions, European exploration, the Industrial Revolution, the rise of the nation-state, and globalization (specific units will be

determined by the instructor). Within each of these units, students will be exposed to both substantive historical literature on the topic as well as major theoretical works that have influenced historical scholarship. In this way, students will be encouraged to think about the ways historians use theory to frame and inform their scholarship and teaching. By the conclusion of the course, students will be expected to demonstrate the integration of content, theory, and pedagogy.

HIST 595: Internship

1-12 Credits/Maximum of 12

Supervised off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

Prerequisite: prior written approval of proposed assignment by instructor

HIST 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

HIST 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

HIST 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

HIST 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

HIST 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Students enrolled will lead discussion sections, grade papers and examinations, given an occasional lecture, and assist instructors in planning survey level courses.

HIST 603: Foreign Academic Experience

1-12 Credits/Maximum of 12

Foreign study and/or research constituting progress toward the degree at a foreign university.

HIST 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

HIST 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

Homeland Security (HLS)

HLS 540: Comparative Homeland Security and Related Methods

3 Credits

The need for a coordinated, international response to security threats to citizens and societies since 9/11 has never been greater. Homeland security in the U.S. is a specific subset of national security that focuses on a risk-informed mission space, addressing it by law-enforcement - as opposed to defense - concepts and capabilities, and working across the country and around the world to keep the American nation safe and secure. Homeland security and civil security policies and strategies to make nations secure and resilient against terrorist as well as all-hazards threats were established not only in the U.S. but also in many other countries in the world, based on the need to work with international partners. This course provides students with information and skills to undertake international comparative analysis of civil security threats and ways to address those threats. Crucial aspects of this course will include a comparative examination of select topics, such as: critical infrastructure protection; cybersecurity; use of armies in homeland security; public-private partnerships; security governance; as well as the creation of "security" as public good and its "delivery" to the citizens in different countries, along with U.S. collaboration with other nations. The course is rooted in the research focus of civil security. This refers to an all-hazards approach to identifying and closing security gaps based on a mission-centered, comprehensive approach (prevention, preparedness, mitigation, response, recovery - plus transversal aspects such as resilience) that is tuned to end-user requirements, and speaks to technological and societal aspects (including ethical and legal issues). Civil security focuses on both 'all of government' and 'whole of community.' It includes dual-use aspects and civil-military interaction in crisis management, but excludes military-only aspects. The course places an emphasis on U.S.-European Union (EU) comparisons based on a related U.S.-EU implementing arrangement, and covers other world regions also. It will further scrutinize comparative analysis of emergent threats and challenges by focusing on risk cultures and security cultures in different countries. Moreover, the course will critically assess - across different countries - citizens perceptions of homeland security and public acceptance of the use of security technology for surveillance and other purposes, across different countries. The comparative perspective cannot be taught without investigating methods and analytical approaches. Lessons will therefore include comparative examination of research-related methods as well as practical methods - such as risk and vulnerability assessment - used in the policy sector, and how and why those differ across countries.

Prerequisite: HLS 811, HLS 813, HLS 801, HLS 803, HLS 805

HLS 558: Whole-Community Disaster Preparedness

3 Credits

Whole-community disaster preparedness describes a fairly wide range of issues of relevance to the homeland security mission space that essentially encompasses aspects of emergency management, such as "ensuring resilience to disasters" as one of the core missions of the U.S. Department of Homeland Security (DHS) - since after 9/11 and the

creation of DHS, the Federal Emergency Management Agency (FEMA) came under the roof of DHS, forming one of its so-called department components. Academically and professionally, disaster psychology contributes an important perspective to emergency management within an all-hazards and a whole-of-community approach to homeland security. Based on a general civil security perspective, it addresses the way people perceive and experience disasters, the way they react to them, and the way they recover from them. Within this context, the course explores the psychological impact of disasters and terrorist attacks on victims, families, rescuers, and society and methods of reducing negative psychological effects. Topics covered include the perception and communication of risk, psychological effects of traumatic events, and psychological interventions to reduce harmful psychological effects of disasters.

Recommended Preparations: Prior graduate work in homeland security, emergency management, disaster research, or psychology.
Cross-listed with: PSY 558

HLS 594: Research Topics

3 Credits

The course builds on the knowledge components and skills students have gained in prior courses in the program, and students should actively use and integrate those during their work in this capstone course. The purpose of this course is to provide a culminating study and research experience in order to develop additional competencies in problem identification; conducting, using, and interpreting research for problem solving; professional writing and oral presentation; as well as group research and presentation skills. During the course, students will work both individually and within one of several assigned groups. The course therefore requires students to demonstrate evidence of analytical ability and synthesis of material, as gained in the iMPS-HLS program. Students are also expected to actively use knowledge, analytical insight, and experience gained in previous classes and throughout the program as a whole.

Prerequisite: HLS 801, HLS 803, HLS 805, HLS 811, HLS 812, HLS 813, HLS 558

HLS 595A: Internship Experience in the Homeland Security Enterprise

3-6 Credits/Maximum of 6

HLS 595A Internship Experience in the Homeland Security Enterprise (3 per semester/maximum of 6) This one-semester internship is offered in falls, spring, and summer. This one-semester internship is designed to provide real world experience in the Homeland Security Enterprise. The course is an elective for students in the Intercollege Master of Professional Studies in Homeland Security (iMPS-HLS) program. Internships can be part-time or full-time and paid or unpaid. Interns may earn 3-6 credits. The number of credits a student can earn will be based on the character of the actual work performed in the internship, in particular the site-specific research project. Interns must complete at least 300 hours on the internship. This is equivalent to working 20 hours per week, although internship schedules are flexible and may be determined on an individual basis. The course includes both an internship and accompanying academic supervision and discussion. It is available to students enrolled in all options related to the program. The course is an additional offering to specialized internship programs that are in place in some iMPS-HLS options. It focuses on a comprehensive real-world experience of the Homeland Security Enterprise: The internship provides real-world experience to enhance the educational experience

and application of knowledge and skills acquired in the program. The accompanying academic supervision and discussion contribute to reaching the overall purpose of the course: to integrate academic and real world learning through an internship opportunity in a workplace setting. Internship activities and assignments are designed to: understand how research and studies are conducted, used, or interpreted in the Homeland Security Enterprise to inform real-world decision-making; to enhance professional development; gain career-related experiences and to provide the opportunity for real-world application of knowledge in a workplace setting; and to prepare for potential job placements. The course places students in numerous workplace and/or research settings that will allow students the opportunity to apply and integrate academic coursework within a professional setting to prepare for further job placement in the Homeland Security Enterprise. Additionally, internship activities and assignments are designed to meet individualized goals and skills, and to evaluate progress toward those competencies. Internship work will be evaluated on an on-going basis with the student intern, site supervisor, and faculty member involved in the process.

Prerequisite: HLS 801 , HLS 803 , and HLS 805

HLS 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

HLS 801: Homeland Security Administration: Policies and Programs

3 Credits

Foundation for understanding homeland security history, the development of homeland security policies and organizations, and current management approaches.

HLS 803: Homeland Security: Social and Ethical Issues

3 Credits

This course will examine the social, political, legal, and ethical issues that arise in the context of homeland security.

Cross-listed with: PHIL 803

HLS 804: Strategic Planning and Organizational Imperatives in Homeland Defense and Security

3 Credits

The course covers the essential concepts of planning for the response to all hazards incidents. The National Incident Management System (NIMS) and its companion policy guidance document, the National Response Framework (NRF), provide broad policy guidance for a comprehensive approach to domestic incident management to prevent, prepare for, respond to, and recover from all hazards incidents. Familiarity with the NIMS and the NRP are essential for individuals to integrate into and be a valuable member of destructive event mitigation and response, whether disasters are natural or human-caused. Critical infrastructure, key resources, and border protection provide the framework for the nation's homeland security and defense efforts. Over eighty percent of these resources reside in the private sector. This presents a challenge to the nation, particularly in the areas of policy guidance and information sharing between the public and the private sectors. These challenges will be presented and analyzed during this course. Participant's understanding of the principles presented will be measured through the

preparation of an analysis of a key homeland security/defense issue related to the materials presented.

Prerequisites: HLS 811

HLS 805: Violence, Threats, Terror, and Insurgency

3 Credits

This course examines political violence committed by non-state groups as it applies to homeland security from both a domestic and global perspective.

Cross-listed with: CRIM 805, PLSC 805

HLS 811: Fundamentals of Homeland Security and Emergency Management

3 Credits

In this course, students will come to understand the history of homeland security as it evolved from the traditional fields of civil defense and emergency management studies. Students will further come to appreciate the problems and prospects of establishing proactive homeland security and emergency management capabilities in a modern threat environment calling for a higher level of preparedness and significantly more awareness. Knowledge will be obtained about how to provide security against various hazards, natural or manmade (e.g., hurricanes, floods, bombings, chemical, biological, or cyber attacks), how to protect critical infrastructures (e.g., transportation, agriculture), and how to plan for effective response and recovery efforts (e.g., first responder, law enforcement, humanitarian relief efforts). The principles and practices of emergency planning and management (e.g., risk analysis, emergency preparedness, incident command) are also discussed in this and other courses throughout the curriculum. Instruction also focuses on new and emerging principles of operating in the interagency, multi-jurisdictional cooperation involving the private sector, law enforcement, academia, nonprofits, and private citizens.

HLS 812: Homeland Security and Homeland Defense in Practice

3 Credits

This course analyzes and evaluates current homeland security, homeland defense, and defense support of civil authorities, plans, and programs, as well as the constraints hindering the implementation of federal and state initiatives. This course has a major goal: to enable students to apply, evaluate, and think critically about homeland security enterprise plans and programs across tiers of government by applying professional as well as policy analysis methods and presenting results in mission space-typical as well as academic formats.

HLS 813: Multifaceted Approaches to Homeland Security

3 Credits

Preparedness and responsiveness have long been part of the law enforcement and military lexicon; however 9/11 expanded the terms' application and the number of people who hold responsibility for their implementation. The result is a growing interest surrounding the nature of the terrorist threat and how intelligence fusion is essential to prevention; the role of the military in civil society; cooperation among federal, state, and local agencies as well as the private sector in response to a catastrophic event; the importance of planning and exercises to improve the mitigation of such events. This course gives an overview of relevant perspectives and concepts related to these topics and develops

a framework that demonstrates their interconnectivity. In addition to providing a conceptual understanding of key ideas, it familiarizes students with the roles played by various entities (e.g., law enforcement, intelligence organizations, the military, and federal, state, and local agencies) and the de facto framework in which they exercise their responsibilities. The course gives students an overview of intelligence and the importance of intelligence fusion as a counter-terrorism force as well as the need for collaboration among all relevant actors and the integration of actions and planning. Finally, it provides an opportunity for students to demonstrate their ability to apply knowledge and methodologies to real-world cases, practically assessing key components in mitigating the impact of future events.

Prerequisites: HLS 811 or HLS 812

HLS 820: Emerging Threats to Homeland Security

3 Credits

This course provides new insights of the emerging threats, disruptive technologies, and techniques for analyzing them to plan for the future of Homeland Security. Emerging threats and disruptive technology is a new field of study in the homeland security enterprise, whether in academia, public, or private sector. Thus, there is very little awareness or understanding of the needed policies, analytical methodologies, and strategic planning to guide homeland security practices over the next generation. In some ways, the homeland security enterprise is operating in a knowledge void, with the potential of being surprised as new and potentially devastating threats emerge. To adapt to this new learning environment we are compelled to take a multi-disciplinary approach to researching and understanding threats, societal context, and applications of advanced technologies.

HLS 821: Transnational Criminal Organizations and HLS

3 Credits

This course will provide an overview of transnational crime and its effects on homeland security. This course will focus on the proliferation and expanding influence of transnational criminal organizations (TCOs) and on the links and significance of TCOs to institutional corruption, trafficking, cybercrime, and terrorism. The class will examine the diverse dimensions of transnational crime in the context of increasing globalization and the exponential impact of technology advances. It will also examine and discuss recent developments in the US regarding TCOs and global efforts to counter narco and human trafficking, Intellectual Property Rights violations, cyber crime, illicit finance, and terrorist ties to TCOs.

HLS 832: U.S. Military's Domestic Imperative: Homeland Defense and Defense Support of Civil Authorities

3 Credits

Provides an overview of the homeland defense mission and defense support of civil authorities during disasters, and the distinctions between the two. HLS 832 U.S. Military's Domestic Imperative: Homeland Defense and Defense Support of Civil Authorities (3) The U.S. Military's Domestic Imperative: Homeland Defense (HD) and Defense Support of Civil Authorities (DSCA), will explain the military's HD mission and DSCA during disasters, and the distinctions between the two. Any prospective homeland security practitioner should understand the basics of the Department of Defense's (DOD) roles, missions, and functions in protecting the homeland, as well as how DOD provides support to civil

authorities. This is especially true if Penn State graduates will be the future leaders of the homeland security enterprise. The course will provide students with the generally accepted body of knowledge in HD and DSCA required of the homeland security professional. The course focuses on: policies and procedures; roles, missions, and functions of DOD in a HD or DSCA environment; key players at the federal, state, and local levels; and critical legal issues. In addition to gaining a broad, general understanding of this wide range of subjects, students will also gain some experience in critical thinking in the disciplines of HD and DSCA.

Prerequisite: HLS 801

HLS 875: U.S. Homeland Security Law

3 Credits

This course assesses the controlling authorities that pertain to homeland security, from the U.S. Constitution to major federal statutes, court decisions, and executive directives. Beyond an analysis of the universal relevance of law to homeland security, specific issues are considered in detail, based on their relationship to U.S. vital national interests. The course also emphasizes the compelling standard that government organizations, as well as the professional practitioner, perform competently in all situations. It provides current and future homeland security practitioners with established knowledge and methodologies in the field of the study of U.S. homeland security law, as applied to practice. It focuses on the essential role that law plays in providing practical solutions for homeland security problems across all preparedness capabilities, from prevention and protection to response and recovery. Beyond application of knowledge from the many dimensions of homeland security law in the context of providing pragmatic solutions for professionals, the course is designed to stimulate critical thinking and improve students' leadership attributes in order to support them in becoming accomplished practitioners, while reaffirming their commitment to the de facto and de jure requirement to preserve fundamental rights and freedoms.

HLS 897: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject with a professional orientation that may be offered infrequently.

Horticulture (HORT)

HORT 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

HORT 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects including non-thesis research, supervised on an individual basis and which fall outside the scope of formal courses.

HORT 596A: **SPECIAL TOPICS**

1-9 Credits/Maximum of 9

HORT 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

HORT 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

HORT 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

HORT 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Provides an opportunity for horticulture graduate students to gain experience in teaching under the supervision of a faculty member.

HORT 603: Foreign Academic Experience

1-12 Credits/Maximum of 12

Foreign study and/or research constituting progress toward the degree at a foreign university.

HORT 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

HORT 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

Hospitality Management (HM)

HM 503: Research Methods in Hospitality Management

3 Credits

An introduction to the process of research; problem-solving approaches; the research proposal and the development of the research question.

Prerequisite: STAT 451

HM 511: Services Marketing Hospitality Management Seminar

3 Credits/Maximum of 999

Hospitality services marketing.

HM 550: Hospitality Applied Research and Consulting

3 Credits

In competitive and dynamic business environments, adopting sound and innovative solutions is critical for the success of most organizations. In this light, the purpose of this course is to help students develop skills necessary to analyze performance issues both quantitatively and qualitatively and to evaluate implemented solutions following sound principles of research design. In addition, students will develop skill in communicating research verbally and in writing for management audiences. Fundamentally, this course will equip students to analyze and solve organizational problems using systematic, scientific methods.

Recommended Preparation: Previous background or coursework in statistics.

HM 560: Hospitality Data Analytics

3 Credits

This course provides a cross-disciplinary perspective to help students analyze, understand, translate, and incorporate common forms of hospitality data in their decision-making processes when designing and executing data-driven strategies. Course topics focus on the application of data analytics in decisions related to labor and human resources, investments, marketing, quality, performance, and security, with the view of advancing a hospitality firm's competitive position. Utilizing cutting-edge analytic software and techniques, students will gain hands-on experience in real-world hospitality contexts through data management, data visualization, and descriptive and predictive analytics.

Recommended Preparation: Previous coursework in statistics.

HM 585: Seminar in Hospitality Management

3 Credits

This course is a doctoral seminar in HM (Hospitality Management) that addresses the conceptual foundations of the HM knowledge base.

HM 586: Data Analysis in Hospitality Management

3 Credits

This course is a doctoral seminar in HM (Hospitality Management) that addresses multivariate data analysis techniques used in hospitality management.

HM 590: Colloquium

1-3 Credits/Maximum of 4

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

HM 594: Research Topics

1-18 Credits/Maximum of 18

Supervised student activities on research projects identified on an individual or small group basis.

HM 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

HM 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

HM 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

HM 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

No description.

HM 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

HM 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

HM 800: Dimensions and Directions of the Hospitality Industry

3 Credits

This course examines of the nature of the hospitality industry at a macro level, along with the environment in which the hospitality industry operates. This course provides an overview of characteristics that distinguish the hospitality industry from other industries and addresses the primary strategic and socio-economic issues relevant to hospitality enterprises. In addition, the course focuses on the complexes of ownership, franchise and brand structures; strategic issues relating to human capital management; and branding and customer loyalty. Current events, market forces, and global trends will be integrated throughout. Ultimately, the course will provide students a broad and integrative overview of the hospitality industry and will foster critical thinking and better decision making.

HM 820: Corporate Officer and Investor Perspectives

3 Credits

This course details the various processes involved in a hospitality real-estate investment. It addresses how potential investors determine the feasibility of a hospitality real-estate investment (market indicators, capital budgeting, and valuation methods). The topics include the various types of management agreements in use in the hospitality industry (franchising, management contracts, other types of affiliation, branding, and licensing), as well as the prevailing financing methods in the industry (mezzanine, recourse or non-recourse, and conduit loans). The course focuses on how investment and financing decisions can optimize firm value, the decision frameworks used to select various forms of financing,

and hospitality asset valuations. The course also addresses the differing interests of the stakeholders involved in the investment process (owners/ investors, financing entities or institutions, and operating companies).

Prerequisite: HM 800; Recommended Preparation: Previous background or coursework in financial accounting and management.

HM 830: Hospitality Profit Optimization

3 Credits

Profit optimization requires the careful coordination of capacity and demand management efforts. This course takes a three pronged approach to addressing the coordination of these efforts. First, it focuses on demand management, and short-term forecasting to predict and influence demand. Second, it examines key capacity management challenges, capacity planning and workforce scheduling, using both optimization and simulation modeling to derive capacity management decisions that balance customer satisfaction with cost efficiency goals. This course addresses the overarching role of pricing in balancing capacity utilization and demand. Pricing will be addressed from a strategic and a tactical perspective, with an emphasis on profit maximization across all revenue-generating assets within the organization, and a profit-oriented approach to distribution channel management.

Prerequisite: HM 800

HM 840: Hospitality Customer Journey and Digital Reach

3 Credits

Marketing of hospitality services needs to address special challenges such as controlling service encounters and customer perceptions of the co-creation process. The first part of the course will tackle how to manage customer expectations during the consumption experience, and thus ensure customer satisfaction. The role of artificial intelligence in shifting customer expectations will also be addressed. The second part of the course will address how to use digital and social channels to promote a hospitality brand. Digital marketing can be executed within social media, search engine optimization, internet, mobile devices and other channels. The role of online reviews is particularly important in the context of travel services. The course will also touch upon topics dealing with marketing in the sharing economy and crisis management implications for marketing global hospitality services.

Prerequisite: HM 800

HM 860: Leading People and Teams in the Hospitality Industry

3 Credits

The human element is vital to the success of any organization, particularly in the hospitality industry. Regardless of the functional area in which students choose to work, they will be required to work with, manage, and lead other people. Therefore, an understanding of leadership and the dynamics of working in and with groups and teams is vital to students' future success. The purpose of this course is to provide students tools for successfully leading teams of employees to enhance organizational performance. Particular areas of focus will be on understanding motivation, individual differences, power and influence, diversity, group dynamics, and conflict management. Students will be familiarized with these content areas and given the opportunity to apply

knowledge of them through project-based work, group assignments, experiential activities, and case studies.

Recommended Preparation: Exposure to management and leadership concepts through prior study in organizational behavior, human resource management, leadership, or related areas, or work experience in a setting that required high levels of interpersonal i

HM 880: Analysis of Future Trends in Hospitality

3 Credits

This capstone course serves as the culminating requirement for the program, requiring students to synthesize and apply the concepts, skills and insights acquired in previous coursework and in practical work environments (either internships or work experience). The course draws on applied readings, industry expert presentations, lessons, and peer discussions. Students will select a hospitality company at the beginning of the course and analyze it over the duration of the course. The case study analysis will focus on a specific area of interest, such as marketing, technology, human resources, organizational culture, finance or operations. As part of the analysis, students will identify and analyze company mission and vision, and relevant internal and external factors that may impact the future strategic direction and decision making of the company. The analysis culminates in a final strategic plan. The final project assesses students' oral and written communication and presentation skills, as well as their analytical and strategic planning abilities. All students will provide their peers with professionally formulated feedback during the course and upon the completion of project presentations.

Prerequisite: HM 800

HM 895: Internship

1-18 Credits/Maximum of 18

Supervised, professionally oriented, off-campus, non-group instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

Human Development and Family Studies (HDFS)

HDFS 501: Human Development Across the Lifespan

3 Credits

Multidisciplinary study of theories and research on human development across the lifespan.

HDFS 502: Biological Systems in Developmental Context

3 Credits

Discusses the development of key biological systems, and their influences on behavior across the lifespan.

HDFS 503: Human Development Intervention: Analysis of Theories and Approaches

3 Credits

Theoretical and empirical analyses of multilevel approaches for enhancing development of individuals and families.

Prerequisite: graduate status in HD FS or related fields; 1st in a sequence

HDFS 504: Consultation in Human Development Intervention

3 Credits

Principles of consultative and collaborative practice with human development intervention programs in formal or informal community settings.

Prerequisite: HD FS503

HDFS 506: Design and Evaluation of Prevention and Health Promotion Programs Across the Life Span

3 Credits

Addresses theory and application of program evaluation, emphasizing process and outcome evaluation strategies for programs involving individuals, organizations and populations. HDFS (HPA) 506 Design and Evaluation of Prevention and Health Promotion Programs Across the Life Span (3) This course is designed for graduate students interested in the design and evaluation of programs in a wide range of human services (e.g., health care, social services, education). The course provides a foundation in the theory and application of program evaluation, with focused attention to the details of how such work can be proposed and conducted. The majority of the semester will focus on issues related to developing scientifically sound and viable studies of interventions in line with students' interests. The goals for this course are to help students build the knowledge and confidence to evaluate human service programs and/or policies that are implemented in research settings (academic or government) and communities or community settings (e.g., schools, health care facilities, community agencies).

Prerequisite: HD FS503 and HD FS516 ; or H P A564

Cross-listed with: HPA 506

HDFS 508: Best Practices in Preventive Intervention

1-6 Credits/Maximum of 6

Implementing empirically validated preventative programs; discussion and evaluation of theory and techniques.

Prerequisite: HD FS503

HDFS 512: Developmental Cognitive Neuroscience of Adolescence

3 Credits

In this course students will evaluate a mix of foundational and cutting-edge research and theory investigating various changes during adolescence principally from a developmental cognitive neuroscience perspective. Particular emphasis will be placed on understanding the application of non-invasive neuroimaging techniques (e.g., functional magnetic resonance imaging, EEG) and the critical role these tools have played in our understanding of adolescent development. Topics to be discussed include (but will not be limited to) structural brain development, maturation in cognitive control functions (e.g., working memory, inhibitory control), as well as affective (e.g., emotion and reward processing), and social information processing. We will also examine factors contributing to adolescent decision-making and risk-taking behaviors.

Cross-listed with: PSY 512

HDFS 515: Professional Issues in Human Development and Family Studies

1-6 Credits/Maximum of 6

Overview of issues in professional development for careers in human development and family studies.

HDFS 516: Methods of Research in Human Development

3 Credits

Review of basic research methods and statistics as applied to human development and family studies.

HDFS 517: Multilevel Methods for Developmental Research

3 Credits

This course provides an overview of multilevel regression models for students pursuing applied statistical analysis of correlated data. We will consider the primary applications for multilevel models that involve working with data that have hierarchical/nested groupings, repeated measures, and extensions of both (e.g., more involved growth trajectories). This course will cover how best to approach manipulating both fixed and random effects (i.e., in a "mixed model") as well as assessment of model fit. We will work with the type of data that are suitable for multilevel analysis, where estimated parameters can represent both broader and more specific contextual levels. Presentation of theory will cover across-discipline uses of these models (and the various other names they go by such as hierarchical linear models, random coefficient models, etc.) and will aim to set a foundation for those who want to pursue more advanced modeling approaches (e.g., using latent constructs) in future coursework.

Prerequisite: at least three statistics courses, including correlation and regression analysis

HDFS 518: Applied Statistics Laboratory

1 Credits

This course provides graduate students with practical skills in data entry, data management, and applied statistical analyses.

HDFS 519: Methods of Statistical Analysis in Human Development

3 Credits

An overview of basic statistical concepts, models, and methods for the analysis of development and change.

Prerequisite: H DEV516 , introductory statistics

HDFS 521: Child Maltreatment: Theory, Research, and Impact

3 Credits

Theory and research pertaining to the causes, bio-psycho-social consequences, and the public health impact of childhood maltreatment. The purpose of this course is for students to learn to think critically about child maltreatment concepts, research, and treatment. Students will be thinking about child maltreatment at multiple levels, including individual, family, and prevention. Therefore, this course will review the breadth of literature on the biological, psychological, and public health impact of child maltreatment including sexual abuse, physical abuse, and neglect. The course will cover the prevalence and history of child

maltreatment, long-term outcomes of maltreatment, research methods, and evidence-based treatment and prevention approaches. State-of-the-art research in the areas of prevention, treatment, biological sequelae, developmental consequences, and intergenerational transmission will be covered. Building on existing research, students will learn to apply critical thinking skills in order to recognize, articulate, and apply the concept of scientific impact to the field of child maltreatment.

HDFS 523: Strategies for Data Analysis in Developmental Research

3 Credits

This course provides the skills necessary to confront the data analytic issues presented in the Human Development and Family Studies methodology core curriculum.

Prerequisite: HD FS519 or STAT 501

HDFS 525: Introduction to Family Studies

3 Credits

Introduction to current theory and research about micro and macro forces related to family relationships and development.

HDFS 526: Measurement in Human Development

3 Credits

Principles and methods for assessment of human developmental processes across the life span.

Prerequisite: EDPSY450 or PSYCH404 ; HD FS519
Cross-listed with: PSY 526

HDFS 527: Social Epidemiology

3 Credits

Application of epidemiological methods to issues in the study of human development.

Prerequisite: HD FS503 , HD FS516

HDFS 528: Observational Methodologies for Development

3 Credits

Design and application of observational methods in developmental research.

Prerequisite: graduate student standing in HD FS or psychology
Cross-listed with: PSY 528

HDFS 529: Seminar in Child Development

1-6 Credits/Maximum of 6

Readings and reports on recent findings in child development.

Prerequisite: 6 graduate credits in child development, child psychology, or educational psychology; 3 in statistics
Cross-listed with: PSY 529

HDFS 530: Longitudinal Structural Equation Modeling

3 Credits

Exposure to a wide variety of statistical models as special cases of the General Linear Mixed Model with latent variables. HD FS 530 Longitudinal Structural Equation Modeling (3) This course provides a broad overview of structural equations modeling as a method for studying developmental processes in Human Development and Family Studies. In this course, students gain a thorough hands-on understanding of a wide variety of statistical model types as special cases of the General Linear Mixed Model (GLMM) with latent variables. Specific statistical model types covered include: exploratory and confirmatory factor analysis; linear, nonlinear and multivariate latent growth curve modeling; quasi-simplex modeling; longitudinal factor modeling; multi-group factor analysis, including a concise introduction to behavior genetic modeling; mediation analysis; testing for measurement equivalence; MANCOVA with nonstandard within-subject covariance structures; outlines of statistical selection theory and principal component analysis. The presentation of these diverse model types as special instances of the same GLMM is helpful to understanding their relationships and differences and considerably streamlines applied statistical modeling. Each of these statistical model types are commonly used to analyze data from studies in the field of Human Development and Family Studies and illustrative examples are provided. Each model type is explained at 4 levels: 1) in terms of a set of simultaneous model equations; 2) as a set of matrix equations; 3) as a graphical model; and 4) as a Lisrel input code. All model assumptions are made explicit and the interrelationships between the 4 levels of model representation are emphasized. Then the model is applied to simulated and real data. The obtained model fits are assessed in terms of various statistical criteria and conclusions are explicitly drawn based on standard statistical decision theory. Selected models from studies of Human Development and other social sciences are interpreted in terms of content and possible pitfalls in their interpretation are discussed. For each modeling technique appropriate background publications, lecture notes and advanced reading material on nonstandard topics are provided.

Prerequisite: HD FS523

HDFS 531: Family Disorganization: Stress Points in the Contemporary Family

3 Credits

Focuses on divorce, remarriage, incest, family violence as well as problems associated with family formation and parent-child relations.

Cross-listed with: SOC 531

HDFS 532: Childhood Obesity

3 Credits

This course addresses how genetic predispositions, behavioral and environmental factors affect children's obesity risk and examines strategies for obesity prevention. HDFS (NUTR) 532 Childhood Obesity (3) This course will examine the epidemic of obesity, particularly childhood obesity, and how various behavioral and environmental factors place children at risk of becoming overweight. Sources of influence that will be examined include: children's nutrition and physical activity behaviors, the family environment, the school environment and community characteristics. Media, social policy and economic factors will also be addressed. In addition, the health and psychosocial consequences of

obesity, ethnic and socioeconomic disparities in the prevalence and predictors of obesity among children and adolescents will be addressed. At its conclusion, this course will examine policy initiatives and obesity prevention programs.

Cross-listed with: NUTR 532

HDFS 533: Adult Obesity

3 Credits

Important current and emerging topics in obesity research relevant to government policy and general public education; emphasis on adult obesity. HD FS (NUTR) 533 Adult Obesity (3) This course will examine the epidemic of obesity, particularly adult obesity. Obesity: Causes, Consequences and Treatment will provide a forum to introduce and discuss current and emerging topics in adult obesity research, with emphasis on policy, prevention and treatment. Focus will be given to determinants of adult obesity and translation into government policy and efforts to educate the general public on the most effective strategies for body weight regulation, obesity prevention and treatment. Sources of influence that will be examined include: environment, genetics, neural, peripheral and sensory mechanisms, food properties and food supply, and therapies and treatment of adult obesity.

Cross-listed with: NUTR 533

HDFS 534: Person-Specific Data Analysis

3 Credits

This course covers statistical dynamic systems modeling of multivariate psychological time series obtained with single and multiple subjects.

HDFS 535: Integrating Qualitative Methods into Quantitative Research

3 Credits/Maximum of 999

Focuses on effective ways to integrate qualitative methods into quantitative approaches to research in human development and family studies. The purpose of this course is to cover how best to combine quantitative and qualitative methods in human development and family studies research. This course begins with the assumption that students have an existing research question to test through quantitative approaches that involve the formulation of research hypotheses before data collection. The course then explores how qualitative data approaches can further enhance their study. This course emphasizes the integration of qualitative and quantitative approaches through 1) designing qualitative projects to test hypotheses, 2) the importance of sampling, and 3) coverage of R for analyzing both qualitative and quantitative data. The course begins with an overview of mixed methods research. The course then addresses qualitative research and the development of qualitative research projects, before describing how to combine quantitative and qualitative data. The course will address best practices for sampling in mixed methods research. The course then will cover specific issues in qualitative research such as ethnographic data, intensive interviewing, and focus groups. The remainder of the course will cover specific issues in mixed methods designs, such as research designs, divergent findings, life history calendars, and statistical programs for mixed methods data.

Prerequisite: HD FS 516

HDFS 537: Biosocial Perspectives on the Family

3 Credits

The implications of knowledge from behavioral endocrinology, behavior genetics, and evolutionary psychology for understanding family relationships and child development. HD FS 537. (SOC 537) Biosocial Perspectives on the Family (3) Breakthroughs in the way biological variables are measured and modeled have generated new findings that greatly increase our understanding of the reciprocal influences between family relationships, child development, and biological factors. Specifically, advances in the study of hormones, genetics, evolution, pharmacology, and immunology have led to important advances in our knowledge of gender, becoming a parent, early child development, middle child, and adolescent development, parent-child relations, courtship and mate selection, quality of intimate relations, separation and divorce, incest, and dominance and family violence. Students are required to keep a journal of researchable ideas during the first five weeks of class. The purpose is to give students practice in identifying research needs and opportunities. The journal should include 4-6 research problems, each developed in 2-3 typed pages. The majority of each entry should be a clear statement of what knowledge gains would be realized by conducting the study and why they are important. The remainder of the statement should include consideration of the data you would use, measures of major variables, and analytic strategies. Think of it as a brief portfolio of thesis, dissertation, or research publication ideas. Entries on research projects in which you are already involved are not eligible for inclusion in the journal. On the last page of the journal, indicate which problem you would like to develop into a more detailed proposal during the remainder of the semester and why. Turn in the journal during week 5. I will evaluate your entries and comment on your selection idea. The rest of the semester will be spent on developing one of the ideas to a full-blown proposal (about 20 pages). You should turn in as many drafts as needed to receive a good grade for this segment of the course. I expect you to turn in three or more before the end of the semester. We will meet about each draft and go over my comments. Proposal drafts should be spaced out over the semester. The last week of the semester will be devoted to presentations of research proposals after which class members will offer comments and suggestions. Your grade will be based on the proposal draft you turn in the last week of the class. Twenty-one percent of the course grade is based on the research proposal.

Cross-listed with: SOC 537

HDFS 538: Dynamical Systems Methods and Applications

3 Credits

The course will provide an overview of the concepts and theory behind dynamical systems. Practical methods for exploring linear and nonlinear relations in multivariate longitudinal data, as well as methods for fitting dynamical systems models to panel and intensive longitudinal data (e.g., diary / experience sampling / ecological momentary assessments) will be presented. Examples may include difference and differential equation models, structural equation models with regime switching/latent transition, and mixture/random effects extensions of these models. A variety of examples of dynamical systems from developmental research, family studies, and intervention science will be presented to provide some perspectives on when Dynamical Systems techniques might be useful. We will also develop hands-on familiarity with different types of dynamical systems by using software programs to simulate, fit, and assess model-fitting results from different dynamical systems models. Students are encouraged to bring research issues and data

pertinent to their own interests to class for discussion and critique.
 Recommended Preparations: HDFS 523 or other equivalents covering regression and multivariate data analysis techniques. The prerequisite may be waived or replaced with other courses in consultation with the instructor. Prior experience in mixed effects modeling and/or structural equation modeling is helpful, but not required.

Prerequisite: HDFS 523

HDFS 539: Seminar in Adolescent Development

1-6 Credits/Maximum of 6

Cultural, psychological, and biological aspects of the developmental transition to adulthood.

Prerequisite: 6 credits in individual development or psychology; 3 credits in sociology and statistics

HDFS 540: Parenting: Theory, Research and Intervention

3 Credits

Review of current theory, research, and intervention in the study of parenting. HDFS 540 Parenting: Theory, Research and Intervention (3) This course is designed to have students think critically about parenting and parenting competence by reviewing theoretical, ideological, and empirical literature. Competent parenting is a key factor in producing desirable child outcomes. Therefore, in this course, parenting competence reflects the behaviors and practices parents use that contribute to the child's ability to function in society. In particular, the course will examine how parenting behaviors, such as warmth/responsiveness, and forms of discipline promote desired child outcomes in attachment relationships, conscience development, internalization of values, and other socio-emotional outcomes.

Prerequisite: HD FS501 or HD FS525

HDFS 541: Optimization of Behavioral and Biobehavioral Interventions

3 Credits

Evidence-based behavioral and biobehavioral interventions are used to prevent and treat health problems (e.g. school-based drug abuse prevention; smoking cessation treatment), improve educational attainment (e.g. reading improvement interventions), and promote health and well-being (e.g. parenting skills training). An intervention may be aimed at any age and delivered in any context; may be aimed at individuals, families, organizations, or communities; and may include both behavioral components and medical components such as pharmaceuticals. The purpose of this course is to enable students to understand and apply quantitative, empirical research methods for optimization of evidence-based multicomponent behavioral and biobehavioral interventions. These methods are used for two related purposes. First, they are used to obtain knowledge about what intervention components work and for whom. Second, they are used to build optimized evidence-based interventions that are not only effective, but also efficient, economical, and scalable. The methods can be used to build new interventions, improve existing interventions, or identify good approaches for implementing interventions. The course will cover a comprehensive framework for empirical development, optimization, and evaluation of evidence-based behavioral and biobehavioral interventions. Students will learn how to craft a detailed conceptual model for an intervention under development, based on existing scientific theory and literature, and the student's own ideas. A substantial amount of time in

the course will be spent on experimental design for optimization trials, particularly factorial experimental designs and variations such as the fractional factorial. The emphasis will be on making the best use of available resources so as to gather the highest-quality and most relevant scientific information. Students will learn how to identify the most appropriate and efficient experimental design for an optimization trial. Practical matters, such as guarding against implementation errors when conducting an experiment in a field setting, and dealing with errors if they occur, will be reviewed. Appropriate statistical analysis of data gathered during an optimization trial will be discussed. Students will learn how use the empirical results obtained in an optimization trial as a basis for selection of the components and component levels that will make up the optimized intervention. Students will also learn how the approaches covered in this course are applicable across a broad range of intervention types and objectives, and also to determine how these approaches are applicable to optimization of interventions in the students' own individual fields of scientific endeavor.

RECOMMENDED PREPERATION: A minimum of two graduate-level statistics courses, covering at least up through multiple regression.

HDFS 546: Seminar in Family Relationships

1-9 Credits/Maximum of 9

Interpersonal interaction within family systems throughout the life cycle.

Prerequisite: I F S418

HDFS 549: Developmental Theory

3 Credits

Conceptual frameworks and major contributions to the study of individual development across the life-span.

Prerequisite: 6 credits at the 400 level in individual development or psychology

Cross-listed with: PSY 549

HDFS 552: Child Maltreatment: Developmental Processes and Biological Embedding

3 Credits

The purpose of this course is to review the breadth of literature on the biological and developmental impact of child maltreatment including sexual abuse, physical abuse, and neglect on youth victims. Students will learn how to integrate child maltreatment research into a relevant, cohesive framework for understanding child maltreatment's wide-reaching effects. The biological focus of the course will be on the health consequences of child maltreatment as well as the neurological, neuroendocrine, and genetic embedding of child maltreatment. The course will also focus on the developmental antecedents and sequelae of child maltreatment through childhood, adolescence, and the transition to adulthood, including addressing how intergenerational transmission, parenting, interpersonal relationships, and attachment are associated with exposure to child maltreatment.

Cross-listed with: BBH 552, PSY 552

HDFS 553: Child Maltreatment: Policy, Administrative Data Systems, Prevention, and Treatment

3 Credits

The course will provide an overview of the major components of the child welfare system (e.g., child protection, family court, foster care, congregate care) involved in the community response to child maltreatment and promote a critical analysis of key federal policies that guide system activities. Course participants will also become familiar with Federal, state, and community data systems, and with methods to develop integrated data systems and their relevance to evaluating system outcomes and policy effects related to the child welfare system. Next, the course will give an overview of a range of experimental, quasi-experimental, and observational research designs and analytic methods relevant to evaluating the effects of child welfare policies and practices on child and family outcomes related to child maltreatment and system involvement. Finally, class participants will apply course content to develop applied research proposals that leverage administrative data for systems research and examine methods for communicating research findings to impact policy and practice at the community and federal levels. This course will also provide an in-depth examination of the major behavioral interventions, both preventive and treatment, applied with the child maltreatment population. Students will first be given an overview of the philosophy of science and experimental methods used to establish behavioral interventions for child maltreatment. From there, students will review emerging paradigms within national funding agencies that focus on identifying and targeting mechanisms to optimize intervention effects.

Cross-listed with: BBH 553, PSY 553

HDFS 569: Seminar on Development in Middle Age

1-6 Credits/Maximum of 6

Interdisciplinary approach to study of human development in middle age, including psychological, cultural, and biological aspects.

Prerequisite: HD FS501

HDFS 575: Applied Longitudinal Data Analysis

3 Credits/Maximum of 999

Students learn techniques for analysis of intensive longitudinal data in the social sciences. The purpose of this course is to facilitate formulation of research questions, design of studies, measurement devices, and methods of analysis suitable for the types of empirical data obtained in intensive longitudinal studies (e.g., diary / experience sampling / ecological momentary assessment) being used in the social sciences. Students will gain skills useful in the study of developmental or other change-based processes. In particular, students will gain abilities related to research conceptualization, research design, data analysis, results interpretation, and the presentation and critique of longitudinal research. The course will (1) highlight general issues regarding the link between process-oriented research questions and longitudinal study designs, (2) survey a selection of intraindividual change and variability concepts, (3) provide step-by-step instruction on data manipulation, graphing, and the analysis of intensive repeated measures data (univariate and multivariate), and (4) develop students' skill in effectively communicating the features of longitudinal data and results of longitudinal analysis. Specific topics include the use of intraindividual variability metrics, multilevel models, generalized multilevel models, multivariate multilevel models, and P-technique factor analysis for measurement and modeling

of dynamic characteristics and dynamic processes; the design and implementation of multiple time-scale studies; and how new technologies are shaping both the collection and analysis of intensive longitudinal data in the social sciences.

Prerequisite: HD FS 519 or STAT 501

HDFS 577: Poverty, Policies, and Child Development

3 Credits

Focuses on interrelationships among families, poverty, and social policies.

Prerequisite: HD FS525

HDFS 578: Contemporary Issues in Interdisciplinary Educational Intervention Sciences

2-3 Credits

Proseminar exploring contemporary issues in the design and evaluation of educational interventions from an interdisciplinary perspective.

Cross-listed with: EDPSY 578, PSY 578

HDFS 579: Seminar in Adult Development and Aging

1-9 Credits/Maximum of 9

A seminar dealing with specific topics concerning adult development and aging.

Prerequisite: I F S445 , statistics

HDFS 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

HDFS 595: Field Projects in Individual and Family Studies

1-9 Credits/Maximum of 9

Supervised research or internship in human services program.

Prerequisite: instructor's approval of proposed project

HDFS 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

Prerequisite: instructor's approval of proposed study

HDFS 596B: ****SPECIAL TOPICS****

3 Credits

HDFS 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

HDFS 597A: ****SPECIAL TOPICS****

3 Credits

HDFS 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

HDFS 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

HDFS 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Supervised experience in teaching and orientation to other selected aspects of the profession at The Pennsylvania State University.

HDFS 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

HDFS 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

Human Resources and Employment Relations (HRER)

HRER 500: Topics in Comparative Industrial Relations

3-6 Credits/Maximum of 6

Similarities and differences of various aspects in industrial relations assessed within the political, economic, and historical contexts.

HRER 501: Labor and Employment Law

3 Credits

Legal context of employment in the United States.

HRER 502: Human Behavior at Work

3 Credits

This course takes an individual, group, and organizational perspective to deepen students' knowledge of individual and team behavior in organizations.

HRER 503: Seminar in International Human Resources Studies

3 Credits

Seminar course exploring human resource studies from an international perspective.

HRER 504: Seminar in Employment Relations

3 Credits

Theory, process, and issues of employment relations, including collective bargaining and contract administration.

HRER 505: Seminar in Human Resources

3 Credits

Current human resource topics in the context of organizational strategy, planning, and responsibility.

HRER 510: Introduction to Graduate Studies in Human Resources and Employment Relations

1 Credits

An overview of professional development and research activities of scholars of Human Resources and Employment Relations.

HRER 512: Research Methods and Analytics in Human Resources and Employment Relations

3 Credits

HRER 512 Gives students an overview of empirical analysis of the employment relationship. Through training in issue identification, model building, specification, sampling and data collection, quantitative and qualitative analysis, recognition of statistical significance and error, and careful interpretation of results, this course provides a solid foundation on which the student will question and build human resources practice and theory. HRER 512 focuses on specific methodological approaches such as survey research that can be applied in a workplace setting. The course includes applied skill-building activities in the areas of problem identification, exploration of alternative solutions to resolve problems in the work setting, survey design, basic analysis of information obtained from surveys, and evaluation of the results of research studies. Students will develop extensive skills in using spreadsheet software, including data cleaning and management, table formatting, charting, functions, and data analysis tools including correlation, t-test, ANOVA, and regression.

HRER 513: Research Methods in Human Resources and Employment Relations II

3 Credits

Continuation of research design, validity and reliability; experimental design and ANOVA; survey design, and multiple regression models.

HRER 516: Labor Market Analysis

3 Credits

Neoclassical, institutional and systemic theories of external and internal labor markets and their dynamics.

HRER 523: Seminar in Work-Life Dilemmas, Practices, and Policies

3 Credits

The course will provide students with an analytic framework for understanding how social inequalities in race, class, and gender shape experiences in families and the workplace. HRER (WMNST) 523 Seminar in Work-Life Dilemmas, Practices, and Policies (3) This course investigates many of the invisible challenges people face in the 21st century labor market including: what happens when a worker's child is sick; whether mothers are discriminated against in the labor market; what happens to men at work when they have children; whether a person's health is influenced by their work; and if the division of labor at home benefits some people more than others. This course will provide answers to these questions and more through an in-depth investigation of the institutions that structure work-family life in 21st century America. First, the class will consider how work and families have changed in the last 50 years. Second, the students will investigate how inequalities based on gender, race, class, and family structure manifest at work. Third, the course will investigate how work responsibilities impact home life and how this differs according to race, gender, class and family structure. Finally, the course will ask what solutions may fix some of today's most pressing work-life dilemmas.

Cross-Listed

HRER 526: Managing Talent Flow

3 Credits

This course covers the strategic management of talent into, through, and out of organizations including recruiting, selection, and employee transitions. This course covers one of the main functional areas of Human Resource Management, staffing, and prepares students to be effective staffing professionals. The course focuses on the effective management of the flow of talent into, through, and out of organizations. Particular attention is given to the impact of business strategy, internal and external labor markets, recruiting, selection, and analytics on staffing practices. We will cover human resource planning, layoffs, career transitions, and other workforce movement. Experiences focusing on the transfer of course material to real-world situations will be an integral part of the class.

HRER 527: Talent Development and Change Management

3 Credits

This course focuses on HR/ER consulting capabilities, change management efforts, and the strategic development of talent and competencies required to execute strategy and attain individual and organizational goals. Change management and talent development efforts are anchored in organizational goals and strategies. The entire change management or talent development initiative must be understood within the broader organizational system of which it is a part. Due to external forces such as technology and globalization, the pace and intensity of change and development efforts have increased dramatically. Effective implementation of such efforts rests on a deeper understanding of the theories and models that guide practice so they may be critically

evaluated, adapted, and supported to maximize the likelihood of success. The outcome of these efforts are enhanced employee competencies that are of strategic value to the organization and improved support of organizational change efforts. As organizations evolve, change efforts must be adapted and the talent profiles and competencies required to support strategic execution must evolve. This course provides the depth and analytical understanding that will enable students to evaluate and flexibly adapt change and talent development theories and models to fit specific organizational contexts.

HRER 536: Diversity in the Workplace

3 Credits

Women and minorities in the workplace.

HRER 588: Capstone in Human Resources and Employment Relations

3 Credits

This is the capstone research course designed to support students as they synthesize prior learning with a topic of interest about which they will conduct research. This capstone course incorporates a review and synthesis of material from across the entire human resource management and employment relations curricula. Domestic and international research and issues relevant to workers, other stakeholders in the employment relationship, and the effective acquisition and management of organizations' human resources will be central to the course, as will the legal, ethical, and diversity related issues that pertain to them. Topics to be reviewed and integrated include: - Strategic human resource management - International human resource management - Functional areas of human resource management - Employment relations and global worker rights - Data analytics - Legal, ethical, and diversity related issues By way of an example, if a student were interested in exploring the rise of the gig economy, they would be encouraged to observe this phenomenon first from the perspective of how this impacts the HRM strategy of an organization. They would then look at the global implications of the gig economy, and then consider how this might affect different HRM functions such as performance management or training of gig economy workers. The topic would then be considered from the perspective of how employment relations theories enhance understanding of gig economy workers. In the following two weeks, students would explore empirical evidence through data analytics specific to the gig economy. Finally, they would review the legal, ethical and diversity issues related to the gig economy. In this way, the student week-by-week constructs an in-depth research paper that adopts a multi-perspective approach based on both theory and empirics.

CONCURRENTS: All degree and option requirements must be met prior to taking this course or be met concurrently in the same semester this course is taken.

HRER 594: Research Topics

1-18 Credits/Maximum of 18

Supervised student activities on research projects identified on an individual or small-group basis.

HRER 595: Internship

1-18 Credits/Maximum of 18

Supervised off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

HRER 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

HRER 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

HRER 599: Foreign Studies

1-12 Credits/Maximum of 24

Full-time graduate-level foreign study at overseas institution with whom linkages have been established.

International Cultures (IL)

HRER 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

HRER 801: Comparative and International Employment and Labor Law

3 Credits

Survey of employment and labor laws around the world that shape the practice of international human resource management (IHRM). HRER 801 Comparative and International Employment and Labor Law (3) This course surveys how the employment and labor laws of countries around the world help to shape the practice of international human resource management (IHRM). It examines such laws and regulations as they affect a representative spectrum of HR concerns, ranging from hiring and contract formation, to anti-discrimination laws and union relations, to personal privacy. The course first examines the role of culture and employment and labor law in the field of international human resources management (IHRM). Students will be asked to address how different national legal regimes affect important HR policies and practices involving the formation of compensation, firing or layoff of employees, anti-discrimination measures, works councils, and mergers and acquisitions. In addition to comparative (national) law, a growing body of "supra-national" regulation - much of it issued and supervised by the International Labor Organization - sets the stage for the latter weeks of the course. These lessons examine how international labor standards are created and can then adopted as part of unilaterally issued corporate codes of conduct or incorporated into bargained-for international framework agreements (between multinational companies and global union federations). Upon completion of the course, students should have a solid foundation for navigating through national and international law in their formation and implementation of HR policies and practices.

HRER 802: Human Behavior and Organizational Performance

3 Credits

This course helps students understand individual and team behavior in organizations and its impact on individual, team, and organizational effectiveness. HRER 802 Organizations in the Workplace (3) Through

the case method, students will be challenged to think critically about real-world problems faced by employees, managers, and organizational leaders. Incorporating basic theoretical principles, we will brainstorm and explore possible approaches to diagnosing those problems and implementing solutions. The approach to learning is purposefully interactive and open-ended, although each module will include some readings summarizing relevant current academic research that provide a framework for thinking about the case. Team exercises and a term paper also provide opportunities for more in-depth exploration of one or more issues introduced during the course of the semester. Students should leave the class with (a) practice in critical thinking; (b) tools for analyzing and managing their own careers in organizations; (c) exposure to some basic concepts from organizational and management science; (d) knowledge about several real-world managers, companies and industries. Evaluation will be based on participation in online case discussions (40%) and written case memos (20%), an individual career and network assignment (20%), and an individual or team option final project involving a paper (10%) and presentation (10%). All letter grades will be assigned in accordance with the University's grading policy.

HRER 803: Human Resources in Multinational Enterprises

3 Credits

This course examines current human resource management (HRM) systems world- wide and the influence of globalization on HRM practice.

HRER 805: Human Resource Management

3 Credits

HRER 805 Human Resource Management provides students who are relatively new to the field with a foundation in human resource management (HRM) as a career and a strategic view of the field of HRM. Understanding the importance of alignment among different HRM functions, having a systems perspective, and creating an awareness of multiple stakeholders and their impact on the practice of HRM are central to the course. How the different HRM functional areas including staffing, training, compensation, benefits, safety and health, and performance management individually and interdependently influence organizational performance and success will be emphasized. In addition, the role of ethics and the various forces that shape the talent philosophy and human resource management strategy of an organization will be covered. The role of the HR function as a strategic business partner in the creation and implementation of business policy and competitive strategy for both domestic and global organizations will be considered. Current trends in HRM and priorities including managing a diverse workforce and the challenges and opportunities of globalization, virtual work, changing performance management trends, and the changing nature of work relationships will also be covered. Various HRM career options and professional competencies required for success will also be explored.

HRER 810: Labor and Employment Law

3 Credits

This seminar deals with the development and application of legal rules covering employment relationships in the United States. It will be attractive to the auditory, visual and kinesthetic learner. Among other topics, it covers civil rights laws, common law rules, and statutory protection for employees and the responsibilities and legal protections for employers. In addition, agencies strongly aligned with Employment Law such as the Equal Employment Opportunity Commission (EEOC) will be presented and dissected. Students will be

empowered to understand the state and federal court systems so that they embrace the navigational journey and complexities of employment law issues. Moreover, workplace issues related to Employment Law will be showcased such as Diversity, Equity, Inclusion and Belonging, Microaggressions, Gaslighting and Implicit Bias. In terms of pedagogy and pedagogy the course will emphasize a high level of critical thinking where the student will synthesize, analyze and evaluate case studies and customized vignettes. An appropriate amount of content will integrate Labor Laws which have a strong nexus to the employment law narrative. Furthermore multimedia will be utilized as well as small group cohort exercises, large group exercises, inventories and fishbowl demonstrations. A special feature of the course will be to expose students to SME's who are experts in Employment Law. (Law firms, advocacy groups etc) These industry experts will be showcased individually and as part of a panel/colloquium.

HRER 811: Labor and Employment Law II

3 Credits

Advanced topics in labor and employment law; such areas as immigration, unemployment compensation, and safety/health.

Prerequisite: HRER 501

HRER 816: Labor Market Analysis

3 Credits

Neoclassical economic and institutional theoretical perspectives on labor supply, demand for labor, internal labor markets, wage determination and labor policies. HRER 816 Labor Market Analysis (3) Virtually everyone will eventually develop an intimate acquaintance with the domain of labor markets—the job market, workplace, labor force and household. This course is intended to help students better analyze general issues surrounding work, the market for labor and the employment relationship. It will reveal the interdependence of the economy, workplace structures, labor organizations, household and family structure and public institutions and policies. It will prepare students to more deeply analyze the determination of earnings and employment, and the influence of organizational and individual behavior, government policies and labor relations. The course will examine the structures and processes that comprise the labor market and the range of theoretical perspectives that can be used to understand its operation. It will rely heavily on applying, and critically appraising, the various perspectives from the field of economics, integrated with other approaches. Its scope will include analyzing the level and types of employee compensation, employment opportunities, labor force participation, work and non-work time, earnings inequality, work-life conflict, etc. It also examines how labor markets, employers and workers are affected by interventions such as government regulatory policy, labor unions, discrimination, and technological advancement. Each unit will focus on an issue within labor markets, and how it may be analyzed in a rigorous way, -the individual's decision to participate in the labor force and how much time to devote toward paid work as opposed to leisure, studying and family; - the individual and employer decision to invest in their own "human capital" (employees' skills) via payment of training and higher education; - the employer's demand for labor resources in both the short-run and long-run and its determinants such as output demand; - the determination of wages in perfectly competitive or internal labor markets; - the effect of working conditions, such as hazardous or insecure jobs, on pay; - the influence of employee compensation schemes on productivity and turnover; - the effect of labor unions and collective bargaining on levels of pay, productivity, profitability and employment; - the effect of government

subsidies, taxes, minimum wage, maximum hours and family leave regulations on labor supply and demand, worker earnings and well-being; - the effect of various types of discrimination present in the labor market on gender, race and age earnings differentials; - the influence of the "new economy" (technology, networking) on unemployment and quality of employment (e.g., temporary jobs, work schedules) and income inequality.

HRER 822: Employee Compensation

3 Credits

This course covers one of the main functional areas of Human Resource Management, employee compensation, and prepares students to create and implement effective compensation systems. Compensation systems play a critical role in a variety of ways in creating effective and efficient organizational outcomes. The types and levels of pay are important in an organization's ability to recruit talent. Similarly the ability to retain talent, particularly in the context of competitive global markets, is related to the quality of types and levels of compensation. In this latter context, the course will connect compensation to the manner in which HRER professionals are able to support organizational strategy. The course will also provide illustrations of the primary ways in which compensation contributes to the entire talent management process. For example, the course will provide tools to understand the role equity plays in influencing employee satisfaction with pay policies and practices, and the resulting ways in which employees respond to their assessment of such circumstances. In this context students will learn how compensation policies influence employee motivation, satisfaction, and employee engagement, as well as other ways in which HR professionals respond to compensation-related issues (e.g. employees perception of unfair pay practices).

Prerequisite: HRER 505

HRER 823: Employee Benefits

3 Credits

This course covers one of the main functional areas of Human Resource Management, employee benefits, and prepares students to create and implement effective benefit practices consistent with organization strategy. The course focuses on the systematic assessment required to determine the alignment between employees' benefit needs and organizational goals, as well as the actual creation of an effective and efficient benefit system. In this regard, students will study various benefit options and special topics in benefits (e.g. benefits for executives, comparative international benefit programs).

Prerequisite: HRER 505

HRER 824: Total Rewards

3 Credits

This course covers one of the main functional areas of Human Resource Management, total rewards, and prepares students to be effective compensation and benefits professionals. In this course, students will develop a detailed understanding of the many choices employers make when deciding how to compensate, support, and reward employees, and the consequences of those choices. Students will also learn to think systematically about how the external environmental conditions and internal organizational considerations influence the design and management of an organization's compensation and benefits systems.

Experiences focusing on the transfer of course material to real-world situations will be an integral part of the class.

HRER 825: Strategic Business Tools for HRER Professionals

3 Credits

This course connects Business Strategy, Financial Tools, and HR to an organization's strategic business objectives. HRER 825 Strategic Business Tools for HRER Professionals (3) Students will learn critical concepts associated with business strategy initiatives, including the application of the experience curve, the growth-share matrix and blue ocean strategies. Students will particularly focus on an analysis that supports the creation of a sustained competitive advantage. This process will expose students to the basic accounting processes from which the statements are built, personalize the understanding of the purpose and use of each of the statements, and address many of the financial concepts which will help students gain credibility with other organizational decision makers. Also, students will address such issues as calculating Return on Investment (ROI), other cost/benefit tools, as well as the conceptual framework around which risk management issues affect financial calculations. HR students will develop a comprehensive understanding of tools that link HR policies and practices to the support of business strategy. In this context the critical concept is the use of metrics designed to provide continuous feedback concerning the efficiency and effectiveness of HR efforts. Students will learn how to identify appropriate metrics based on specific initiatives (e.g., talent management), create metrics that are valid and reliable measures of success, and create dashboard (i.e., balanced score cards) designed to provide comprehensive data to all corporate stakeholders.

Prerequisite: HRER 505

HRER 826: Talent Management

3 Credits

This course covers one of the main functional areas of Human Resource Management, staffing, and prepares students to be effective staffing professionals. The course focuses on the effective management of the flow of talent into, through, and out of organizations. Particular attention is given to the impact of business strategy, internal and external labor markets, recruiting, selection, and analytics on staffing practices. We will cover human resource planning, layoffs, career transitions, and other workforce movement. Experiences focusing on the transfer of course material to real-world situations will be an integral part of the class.

HRER 827: Talent Development

3 Credits

This course covers one of the main functional areas of Human Resource Management, training and development, and prepares students to be effective training and development professionals. The course focuses on the systematic assessment required to determine actual learning needs, identifying where learning is best achieved in a training and development intervention, as well as the actual creation of effective and efficient training classes. In this regard students will study training methods, program design elements, and training program assessment methods.

Prerequisite: HRER 505

HRER 836: Diversity in the Workplace

3 Credits

This course examines workplace diversity, gender and race challenges facing employers and employees, and the skills for managing diversity. HRER 836 Diversity in the Workplace (3) This course will examine gender and race issues challenging employers and employees in an age when demographic changes and globalization are significantly increasing the diversity of the U.S. workforce. This course will provide an opportunity for students to explore the various ways in which ethnicity, race and gender, sexual orientation, national origin, and disability impact the workplace. Specific issues to be examined include employment and discrimination laws, work and family policies, human resource practices (such as recruitment and selection), and sexual harassment. The course will also explore various workplace accommodations and strategies for managing diversity in the workplace; sex roles; occupational choices made by women and minorities; and career development. This course is one core requirement for the Masters Degree Program in Human Resources and Employment Relations. It provides graduate course level coverage of topics addressed in L I R 536: Labor Diversity in the Workplace. Mastery of course material will be evaluated through both informal and formal assignments which include case studies, exercises and group activities, participating in on-line discussion, and short essay exams.

HRER 860: Ethical Decision Making for HR Practitioners

3 Credits

Use of normative elements associated with ethical decision making, as well as the emerging interest in descriptive ethics, to address important problems human resource managers confront. HRER 860 Ethical Decision Making for HR Practitioners (3) Increasingly board members, CEOs, Managers (including Human Resource practitioners) and employees are expected not only to understand and apply core organizational values, but also be capable of engaging in ethical decision making at those moments where they are confronted by competing moral demands. HR practitioners find such dilemmas in a wide variety of contexts. Students will study the application of the decision-making model to interpersonal, HR policy making and application, as well as situations involving business strategy. Students will also engage in a detailed examination about how stakeholders actually behave when confronted with moral dilemmas. The need for this insight emerges in related lessons that help prepare students to manage ethical programs. They will learn how to construct a code of ethics and what helps to make codes effective in promoting ethical awareness and eventually ethical action. They will also learn specific techniques that can help create valuable training initiatives that, again, promote ethical awareness and eventually ethical action. One of the themes that will constantly emerge in this course is the unique and important role HR practitioners play in helping groom the ability of all stakeholders to avoid careless decision making when confronting moral choices that are critical to the organization's ability to sustain itself and the communities in which it seeks to thrive.

Prerequisite: HRER 501 , HRER 504 and HRER 505

HRER 865: Diversity and Ethics in the Workplace

3 Credits

This course will help students understand the importance and significance of advancing diversity, equity, inclusion (DEI) and ethical decision-making in the workplace. The course introduces theories and

concepts, research, and practice regarding diversity management and inclusion in the workplace. Adopting psychological, sociological, and economic perspectives, we uncover how biases and stereotypes form and combine with organizational and societal structures to introduce inequality within and across organizations. The course also explores how organizations and managers can engage in a structured, ethical decision-making process as they evaluate options for addressing these inequalities.

HRER 870: Human Resource & Employee Relations in the Age of Artificial Intelligence

3 Credits

This course will provide foundational knowledge required by HR and ER practitioners to serve effectively as thought leaders, solutions providers, enablers of organizational growth and success, and trusted advisers to C-Suite executives during the age of AI. This includes focusing on the core knowledge, skills, and abilities required to create and add value throughout the employee life cycle, and related policies, processes, and procedures designed to develop organizational capabilities. In addition to discussing the potential of AI, the course will also explore the potential perils of AI. This includes algorithmic bias and explainability, misinformation, disinformation, cybersecurity, impact on the development of an inclusive workplace, and organizational governance challenges. Fundamental to accomplishing the above is knowledge of digital firms, their strategies and operating models, core competencies, and international guidelines and toolkits on ethical and socially responsible AI. Students will have an opportunity to undertake an AI related project to demonstrate the ability to apply the knowledge and skills acquired from the course.

HRER 894: Research Topics

1-15 Credits/Maximum of 15

Supervised student activities on research projects identified on an individual or small-group basis. HRER 894 Research Topics (1-15) The course presents an opportunity for students to demonstrate that they can apply the principles, theory, and content studied over the course of the degree to an applied issue of importance in the field of human resources and employment relations. In addition to a description, analysis, and interpretation of the project or findings, all papers will require a literature review, explicit theoretical framework, and standard bibliographical format. Each student will have a faculty mentor who will assist the student during the research and writing phases, and who will evaluate the final paper.

HRER 897: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

Humanities - CA (HUM)

HUM 500: Research Methods and Scholarly Inquiry in the Humanities

3 Credits

Study of the methods and materials of scholarship, use of reference tools, evaluation of evidence, and writing of research papers.

HUM 515: Seminar

3 Credits/Maximum of 9

A seminar focusing on typical methods and approaches of a single discipline within the humanities.

HUM 525: Studies in Aesthetics

3 Credits

Philosophical investigation into the nature of art, aesthetic experience, artistic meaning, criticism, grounds for judgment, and history of aesthetic theory.

HUM 530: Seminar in Comparative Arts

3 Credits/Maximum of 9

A seminar focusing on selected periods or artists in two or more disciplines within the humanities.

HUM 535: Topics in Cultural and Intellectual History

3 Credits/Maximum of 9

Study of methods, issues, and selected topics in the history of thought, social values, and creative expression.

HUM 550: Junior College Teaching Internship

3 Credits

Teaching humanities courses in a two-year college under a faculty supervisor, who will direct, criticize, and evaluate the intern.

Prerequisite: HUM 500 , HUM 560 , 12 additional graduate credits

HUM 560: Interrelations in the Humanities

3 Credits

The study and practice of conducting interdisciplinary research and of investigating and supporting inter-art analogies.

Prerequisite: HUM 500

HUM 580: Master's Production

1-6 Credits/Maximum of 6

An original scholarly master's paper or creative production initiated by the student, supervised by an appropriate professor, and judged by a committee.

HUM 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

HUM 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

HUM 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

Industrial Engineering (IE)

IE 505: Linear Programming

3 Credits

An accelerated treatment of the main theorems of linear programming and duality structures plus introduction to numerical and computational aspects of solving large-scale problems.

Prerequisite: I E 405

IE 507: Operations Research: Scheduling Models

3 Credits

Scheduling models with simultaneous job arrival and probabilistic job arrival, network scheduling, and scheduling simulation techniques.

Prerequisite: I E 425

IE 509: Operations Research: Waiting Line Models

3 Credits

Waiting line models including models with infinite queues, finite queues, single and multiple servers under various priorities and disciplines.

Prerequisite: I E 516

IE 510: Integer Programming

3 Credits

Study of advanced topics in mathematical programming; emphasis on large-scale systems involving integer variables.

Prerequisite: I E 405

IE 511: Experimental Design in Engineering

3 Credits

Statistical design and analysis of experiments in engineering; experimental models and experimental designs using the analysis of variance.

Prerequisite: I E 323

IE 512: Graph Theory and Networks in Management

3 Credits

Graph and network theory; application to problems of flows in networks, transportation and assignment problems, pert/CPM, facilities planning.

Prerequisite: I E 405

IE 513: Stochastic Optimization

3 Credits

This course is designed to provide students with the ability to model optimization problems in uncertain settings and develop and analyze the convergence properties of the associated algorithms. It consists of six parts: 1) Review and Overview of models for decision-making under uncertainty; 2) Stochastic programming (Theory); 3) Decomposition Methods; 4) Monte-Carlo Sampling Methods; 5) Robust optimization; 6) Special topics: Risk-averse optimization, stochastic variational inequality problems; and/or distributed stochastic optimization. Apart from students in Industrial and Manufacturing Engineering, this course would be of interest to students from math, engineering, computer science, statistics, machine learning, economics and operations management. Students are required to have some background in optimization and probability theory.

Prerequisites: IE 505

IE 516: Applied Stochastic Processes

3 Credits

Study of stochastic processes and their applications to engineering and supply chain and information systems. I E (SC&IS) 516 Applied Stochastic Processes (3) This course covers the mathematical fundamentals and tools for analyzing stochastic systems evolving over time, including concepts and techniques related to Poisson Processes, renewal processes, and discrete and continuous time Markov chains. Students will also learn to build probabilistic intuition and insights when thinking about random processes. Additionally, students will learn to apply the essential techniques of stochastic processes to real world problems in the supply chain and information systems area. This is a prescribed research foundation course for Ph.D. students in SC&IS. Student evaluations are based on class participation, individual and group assignments, and exams. This course will be offered during Spring semester to approximately 5-10 students.

Prerequisite: I E 322 or STAT 318

Cross-listed with: SCIS 516

IE 517: Models and Technologies for Financial Services

3 Credits

The objective of this course is to study current and emerging electronic financial services used in enterprise and global supply chain operations. The emphasis will be on technologies used in these services and how they can be used for improving operations. Topics covered include electronic financial services, financial engineering, financial services for enterprise and supply chain operations, modeling cash-flow bullwhip in supply chains, cash-flow forecasting algorithms, and models for sustainable microfinance in supply chains.

Prerequisites: IE 505 or IE 516

IE 519: Dynamic Programming

3 Credits

Theory and application of dynamic programming; Markov decision processes with emphasis on applications in engineering systems, supply chain and information systems. I E (SC&IS) 519 Dynamic Programming (3) This course presents the basic theory and applications of dynamic programming. The focus of the course will be on the theory

of Markov decision processes (MDP), which provides an analytical tool to optimally control the behavior of a Markov Chain. The students will learn fundamental MDP models, computational methods and applications in supply chain and information systems, including production and inventory control, quality control, logistics, scheduling, queueing network, and economic problems. Student evaluations are based on class participation, individual and group assignments, and projects. This course will be offered during Spring semester for approximately 5-10 students.

Prerequisite: I E 516 or SC&IS516 or equivalent
Cross-listed with: SCIS 519

IE 520: Multiple Criteria Optimization

3 Credits

Study of concepts and methods in analysis of systems involving multiple objectives with applications to engineering, economic, and environmental systems.

Prerequisite: I E 405 or INS 427

IE 521: Nonlinear Programming

3 Credits

Fundamental theory of optimization including classical optimization, convex analysis, optimality conditions and duality, algorithmic solution strategies, variational methods in optimization.

Prerequisite: I E 505

IE 522: Discrete Event Systems Simulation

3 Credits

Fundamentals of discrete event simulation, including event scheduling, time advance mechanisms, random variate generation, and output analysis.

Prerequisite: I E 425

IE 525: Advanced Linear Optimization

3 Credits

This is a graduate level course on linear optimization (LO) and its extensions emphasizing the underlying mathematical structures, geometrical concepts, and algorithms. The topics covered include: the geometry of linear optimization, duality theory, the simplex method, sensitivity analysis, large scale linear problems, the ellipsoid method as a polynomial time algorithm for LO, and interior point methods.

Prerequisites: IE 405 Recommended Preparation: An undergraduate course in linear algebra

IE 527: Additive Manufacturing Processes

4 Credits

The course will cover the fundamentals of Additive Manufacturing (AM) processes. During the course the students will leverage their background in computer-aided manufacturing to learn the Digital Work Flow steps from Design to Manufactured AM parts. They will learn and gain experience in the various data representation, algorithms and software tools, processes, and techniques that enable advanced/

additive manufacturing. Computational algorithms will be researched and evaluated. Detailed research investigations into the fundamental process models of various additive manufacturing (AM) processes using polymers, metals, and other material will provide insight into the operating principles, capabilities, and limitations of AM processes. In addition to theoretical knowledge, the students will gain hands-on experience with AM machines and understand the complete process steps through design, fabrication, and measurement of example parts. The students will study the range of applications of AM across a spectrum of industries (e.g., aerospace/automotive, medical devices, and consumer products) while developing an understanding of the requirements, constraints, and business case for the applications. After completing this course, students will have a fundamental understanding of the research in AM processes and prepare them for additional depth in follow on courses. Additionally the students will be able to appropriately utilize (e.g., evaluate, select, design) this developing technology in the future of manufacturing and digital transformation of manufacturing.

Cross-listed with: AMD 527

IE 530: Financial Engineering

3 Credits

Financial option pricing and portfolio design relevant to investment decision making. I E 530 Financial Engineering (3) The objective of this course is to provide students with the basic terminology, concepts, and issues relevant to financial engineering. It serves as an introduction to the investment, financial instruments, and valuation of projects via portfolio theory and option pricing and is primarily for students who have had exposure to multi-variable calculus and probability theory. Students will learn the core concepts and advanced techniques for decision making of capital investment and for managing and valuing risky projects. This course also aims to enable students to effectively use tools in finance and mathematics in order to conduct rigorous research on topics involving the analysis of managing and valuing flexibility and uncertainty. A requisite course in applied stochastic processes will provide the necessary background on probability models needed for this course.

Prerequisite: I E 516

IE 532: Reliability Engineering

3 Credits

Mathematical definition of concepts in reliability engineering; methods of system reliability calculation; reliability modeling, estimation, and acceptance testing procedures.

Prerequisite: I E 323 or 3 credits in probability and statistics with a prerequisite of calculus

IE 533: Workforce Engineering

3 Credits

Methods and applications for selecting, assigning, scheduling, and planning for workforce operations in the manufacturing and service industries. I E 533 Workforce Engineering (3) This course studies the field of workforce engineering, and bridges the areas of human factors engineering, production planning, and optimization. The objective of the course is to examine state-of-the-art practices, models, solution techniques, and opportunities for graduate research. The course studies quantitative applications related to determining workforce size, skill

sets, and multifunctionality in service and manufacturing systems based on measurable quality and productivity performance. Students will develop the skills necessary to model and solve problems considering the tradeoffs between speed and accuracy.

Prerequisite: I E 405 and I E 425

IE 546: Designing Product Families

3 Credits

Product families, product platforms, mass customization, product variety, modularity, commonality, robust design, product architectures. I E (M E) 546 Designing Products Families (3) Designing Product Families is a graduate-level course generally offered in the spring. It is designed for students interested in product realization, engineering design, and manufacturing to gain an understanding of mass customization and methods for designing families of products based on modular and scalable product platforms. The transition from craft production to mass production to mass customization will be covered in this course along with methods and tools for designing robust, modular, and scalable product platforms. Platform leveraging strategies and commonality metrics will be investigated through product dissection activities, which will also be integrated with lectures on evaluating manufacturing and assembly. Several industry case studies will also be discussed in the course to examine the implications of producing a variety of products and strategies for effective mass customization and product postponement. Students interested in taking this course should be familiar with product design and manufacturing. Students are evaluated through individual and group homework assignments, in-class participation and activities, and a group project report and presentation.

Prerequisite: M E 414 or M E 415 or I E 466

Cross-listed with: ME 546

IE 547: Designing for Human Variability

3 Credits

Statistics, optimization, and robust design methodologies to design products and environments that are robust to variability in users.

Cross-Listed

IE 548: Interaction Design

3 Credits

Strategies in user-centered design, ergonomic product analysis, statistical data analysis, low and high fidelity prototyping, and innovative design techniques. EDSGN 548 Interaction Design (3) Interaction Design provides an integrative perspective on the types of human-centered design techniques that can be used to analyze existing consumer products and develop innovative solutions. In this class, students will learn qualitative (e.g., observations and surveys) and quantitative methods (e.g., emg sensing and eye tracking) to measure user interactions. This knowledge will be used develop design recommendations for future products. The material will be presented through a variety of hands-on activities including a semester long interaction design project which requires students to evaluate an existing product using human-centered design techniques, develop solutions based on interaction design principles, prototype solutions, and evaluate their designs in a formal user study. Upon completion of this course, students will be able to identify appropriate research methods (quantitative and qualitative) for guiding interaction design decisions,

conduct a user study, and develop design recommendations based on interaction design principles.

Prerequisite: EDSGN 547 or I E 479 or IST 501 or equivalent

Cross-listed with: EDSGN 548

IE 549: Design Decision Making

3 Credits

Complexity of design-making; state-of-the-art methods and tools. EDSGN (IE) 549 Design Decision Making (3) Students in this course will internalize the importance of information and decision-making in design; understand the complexities due to uncertain information, multi-person decision making, technology obsolescence, competitive priorities; become familiar with state-of-the-art methods and tools for design decision-making; and, demonstrate the application of this knowledge in the context of a collaborative design project. Learning in this course will be facilitated in an "apply what you have learned" fashion with ample opportunities for students to demonstrate their learning through in-class participation, discussion of solved problems, hands-on design projects. Strategies, methods, and means of the design process will be discussed and practiced to include such things as understanding client needs, generating design concepts, and evaluating design ideas.

Cross-listed with: EDSGN 549

IE 550: Manufacturing Systems

3 Credits

Fundamental theory for analyzing manufacturing systems including structural analysis, optimization and economics of manufacturing systems, automated and computer-aided manufacturing.

IE 551: Computer Control of Manufacturing Systems

3 Credits

Analysis of microprocessor-controlled servo loops, adaptive control, stochastic methods in control; analysis of NC machines, robots, and their controllers.

IE 552: Mechanics of the Musculoskeletal System

3 Credits

Structure and biomechanics of bone, cartilage, and skeletal muscle; dynamics and control of musculoskeletal system models. BIOE 552 BIOE (I E) 552 Mechanics of the Musculoskeletal System (3) The course focuses on the upper limbs and its musculoskeletal components, including mechanical properties and models; work-related musculoskeletal injuries, techniques, models, and instruments to measure and quantify the risks for developing such injuries. Specific topics covered in the first third of the course include an introduction to basic biomechanical principles, the anatomical structure of the musculoskeletal system including soft tissue, neuromuscular physiology, and motor control including muscle receptors. The second third covers various muscle models starting from basic mass/spring/dashpot viscoelastic models as in Hill's 3-element model and continuing on to Hatze's multi-element model, frequency analysis, control theory approaches. More complex models include static and dynamic aspects of tendon-pulley models and multiple muscle-tendon systems. The final third covers basic epidemiology as applied to musculoskeletal disorders and risk factors including instrumentation to measure them and various analysis tools (e.g., the PSU CTD Risk Index) to assess the not only the overall risk for injury but the reliability and

validity of such assessments. Time permitting applications to hand tools and office environment with computer work stations are examined. Two exams and a modeling project are given. The course is typically offered Spring Semester.

Prerequisite: Consent of program. Prerequisite or concurrent: BIOL 472
Cross-listed with: BIOE 552

IE 553: Engineering of Human Work

3 Credits

Physics and physiology of humans at work; models of muscle strength, dynamic movements; neural control; physical work capacity; rest allocation.

Prerequisite: BIOL 141 or BIOL 472
Cross-listed with: BIOE 553

IE 556: Robotic Concepts

3 Credits

Analysis of robotic systems; end effectors, vision systems, sensors, stability and control, off-line programming, simulation of robotic systems.

Prerequisite: I E 456 or M E 456

IE 557: Human-in-the-Loop Simulation

3 Credits

Design and programming of simulations that facilitate human control, real-time discrete-event simulation, supervisory control of dynamic system. I E 557 Human-in-the-Loop Simulation (3) This course is designed to provide graduate students with the capability to develop an interactive, real-life simulation and to create interfaces for an interactive simulation. The course will cover key phases in the life cycle of interactive systems development including design, implementation, and evaluation. Course topics will be explored through application in supervisory control of complex, dynamic systems. Java will be the programming language used for software development in this course. Students will understand the fundamental concepts in interactive simulation; learn how to implement random variant generation and event handling in a simulation; understand the uses of human-in-the-loop simulation to investigate human performance within the simulated system; and demonstrate the application of knowledge gained in the course in a project. Human-in-the-Loop Simulation is designed for students interested in human interaction with simulations of dynamic, supervisory control systems. The design and implementation of real-time interactive simulations will be covered. The construction of simulations from basic object-oriented programming concepts will be discussed. The role of the human within a dynamic, supervisory control system and methods of evaluating human performance within the simulated system will be examined. Students will be evaluated via laboratory assignments, two mid-semester examinations, and a semester project.

Prerequisite: I E 418 and I E 453

IE 558: Engineering of Cognitive Work

3 Credits

Information processing and decision making models of the human in the modern workplace, emphasizing visual inspection and other industrial applications.

Prerequisite: I E 323 and I E 408

IE 560: Manufacturing Processes and Materials

3 Credits

Materials processing and manufacturing methods for engineering materials; manufacturing process modeling and control; manufacturability of engineering materials. I E 560 Manufacturing Processes and Materials (3) The course provides a broad exploration of the manufacturability of engineering materials. In particular it investigates the fundamentals of material performance during processing, manufacturability requirements for primary material processing methods, and the processing limitations of widely used material systems. It considers formability, machinability, castability, weldability and, particulate consolidation of metallic systems with emphasis on widely used ferrous and non-ferrous alloys and widely used polymer, composite and ceramic systems. Building upon these insights, students will develop an integrated understanding of material processing science and control, and microstructure/property/processing relationships. They will be able to select appropriate material and manufacturing processes for engineering components and identify critical material and manufacturability issues that limit manufacturing success. Students will be able to apply these principles to develop an understanding of manufacturability constraints for newly developed engineering materials and processing methods. The course is an elective course for all Industrial Engineering MS, MENG and PhD degrees and is part of the required core of courses for the MS and MENG Manufacturing Option.

Prerequisite: E SC 414M , MATSC424 , or I E 470

IE 561: Data Mining Driven Design

3 Credits

The study and application of data mining/machine learning (DM/ML) techniques in multidisciplinary design. CSE 561 / EDSGN 561 / IE 561 / IST 561 Data Mining Driven Design (3) This course examines how theoretical data mining/machine learning (DM/ML) algorithms can be employed to solve large-scale, complex design problems. Knowledge Discovery in Databases (KDD) is the umbrella term used to describe the sequential steps involved in capturing and discovering hidden, previously unknown knowledge in large databases. The course begins with foundational information regarding engineering design and provides an overview of KDD and the emergence of the digital age. Students will investigate data acquisition and storage techniques where they will learn the difference between stated and revealed data as related to design. Students will construct their own databases and learn essential techniques in data base queries (SQL) and management. Data transformation techniques, such as binning and dimensionality reduction, will be examined in the data transformation section of the course. This course has a design-driven focus, which will enable students to solve real-life design challenges spanning diverse domains. Students will work on project-based exercises aimed at proposing novel data mining algorithms, or employing existing algorithms to solve design

problems in fields relating to engineering, healthcare, financial markets, military systems, to name a few. Data visualization techniques will also be studied to help communicate complex data mining models in a timely and efficient manner.

Cross-listed with: CSE 561, EDSGN 561, IST 561

IE 562: Computational Foundations of Smart Systems

3 Credits/Maximum of 999

Methodological aspects of expert systems design and review of some existing systems with emphasis on manufacturing and industrial engineering.

IE 563: Computer-Aided Design for Manufacturing

3 Credits

Study of CAD systems and concepts including 3D wireframe and solid modeling systems, emphasizing manufacturing applications.

Prerequisite: I E 463

IE 566: Quality Control

3 Credits

Advanced quality assurance and control topics, including multivariate methods, economic design for control and acceptance, dimensioning, tolerancing, and error analysis.

IE 567: Distributed Systems and Control

3 Credits

Advances in distributed control and decision-making in enterprises and supply chains with emphasis on computing, algorithms, and dynamics. I E 567 Distributed Systems and Control (3) Recently several new open architecture standards have emerged for control and information systems in industrial enterprises. These standards have been largely driven by industry to reduce the cost of integrating and configuring manufacturing systems, allowing a new breed of distributed enterprises to be engineered. This course deals with the multidisciplinary aspects of controls, computing, and communication in this rapidly evolving area. The objective of this course is to study current research and engineering challenges in distributed systems and control in the context of manufacturing and service enterprises, and supply chains. Emphasis will be placed on understanding the dynamics and computational aspects of decision making and control algorithms in integrated enterprises. Assignments and projects in this course will include designing, programming, and integrating distributed control systems. Evaluation will be based on programming and lab assignments, literature review and class presentation, a semester project, and class participation. This course will be offered every third semester with a maximum enrollment of 18.

IE 568: Healthcare Systems Engineering

3 Credits

Quantitative methods to analyze and improve healthcare systems.

Prerequisite: I E 405 , I E 425 , and I E 433

IE 569: Human Factors in Transportation Engineering

3 Credits

Human Factors in Transportation Engineering is composed of a systematic introduction of major concepts, theories, and methods of human factors research in transportation safety. This course will cover the methods appropriate for studying humans, vehicles, and their interaction. It is designed to prepare graduate students with the knowledge of key topics in driving research, including driver cognition and behavior, vehicle technology, driving impairment, individual difference, driver performance modeling, and other road users.

Prerequisite: IE 408 Recommended Preparation: IE 511 Experimental Design in Engineering or equivalent course that introduces basic concepts in the analysis of experiments.

IE 570: Supply Chain Engineering

3 Credits

Use of operations research models and methods for solving problems in supply chain systems. IE 570 / SCIS 570 Supply Chain Engineering (3) The course provides state-of-the-art mathematical models, concepts and solution methods important in the design, control, operation and management of global supply chains. It provides an understanding of how companies plan, source, make and deliver their products to create/or maintain a global competitive advantage. It emphasizes the application of operations research models and methods to optimize the various components of an integrated supply chain. The course is appropriate for graduate students interested in working in the supply chain area in industry as well as those planning to pursue research in supply chain optimization.

Prerequisite: I E 405 , I E 425 , or SC&IS510

Cross-listed with: SCIS 570

IE 571: Product Design, Manufacturing Specifications, and Measurements

3 Credits/Maximum of 999

Elements of Product Design, Manufacturing Specifications, and Measurements with applications in the design, manufacture, and metrology of discrete parts. Elements of design and manufacturing engineering with an emphasis on the tools, standards, and methods used for product and part representation, specifications, and measurements. Students will learn to identify product dimensional design requirements and develop deterministic and probabilistic solution methods to sets of dependent and independent design requirements. They will then be exposed to industrial interchangeability models and their solutions. This will be followed by an in-depth exposure to the standardization of design and manufacturing, information embodied in the ASME Y14.5 and ISO 1101 Standards. The specification and interpretation of the dimensional and geometric tolerances contained in these standards will be enhanced with applications in design, manufacturing, and metrology. The class will conclude with an introduction to the operation of metrology hardware including Zeiss, OGP, and FARO contact and non-contact measuring machines. The preceding body of material will provide the students with a sound foundation of design and manufacturing knowledge that will serve them in subsequent design and manufacturing classes. Students are expected to have taken a prior class in probability and statistics.

IE 572: Discrete Part Metrology

3 Credits/Maximum of 999

Theoretical considerations and practical applications in the design, acquisition, and interpretations of measurements in discrete part metrology and quality control. Metrology plays an important role at all stages of industrial product realization. Students in manufacturing programs must be well versed in methods of discrete part data acquisition, analysis, and reliability. The main objective of this course is to provide interested students with theoretical and practical knowledge in discrete part metrology for the validation, monitoring, and control of the output of manufacturing processes. Students will learn the ISO GUM and ANOVA-based methods for analysis of measurement uncertainty and apply these methods to the design, data acquisition, and analysis of measurements. They will explore the hardware and software of a typical Coordinate Measuring Machine (CMM), learn to develop a rigid body error model for such a machine and apply the methodology to the development and analysis of error models for other machine tools or measuring machines configurations. They will use laser interferometry tools and other hardware to acquire estimates of some of the components of the error budget. They will also explore the formulation, application, and solution of least squares and minimum zone algorithms to the CMM measurements of ASME Y14.5 size and geometric tolerances. The course will conclude with a short insight into the process planning of metrology tasks using the development of constraint graphs, their analysis, and subsequent sequencing of measurements tasks.

IE 575: Foundations of Predictive Analytics

3 Credits

Survey course on the key topics in predictive analytics. IE 575 Foundations of Predictive Analytics (3) This will be a survey course on the various aspects of predictive data analytics. Students will learn methods associated with data analytics techniques and apply them to real examples using the R statistical system. The key survey topics will include linear regression models, classification methods, tree-based methods, dimensionality reduction, and clustering. The focus will be on providing a basic understanding of the fundamentals of these techniques with realistic applications in marketing, healthcare, engineering and web-based data. An introduction to predictive models based on text and network data will be provided.

Prerequisite: IE 323 , STAT 500 or equivalent

IE 582: Engineering Analytics

3 Credits

Students will learn advanced information technology network science, big data, descriptive and predictive analytics, for manufacturing and service systems.

IE 583: Response Surface Methodology and Process Optimization

3 Credits

Response Surface Methodologies used for sequential experimentation and optimization of production processes. Statistical design and analysis of such experiments. IE 583 Response Surface Methodology & Process Optimization (3) This course considers Response Surface Methodology (RSM), a collection of statistical and optimization techniques aimed at improving the quality characteristics of a manufacturing process through the sequential application of statistically-designed experiments

and model-building techniques. Optimization techniques for response surfaces, functions that can exhibit large sample variability, are highlighted. Multiple response optimization problems, which occur frequently in practice, are considered, and their relation to Taguchi's Robust Parameter Design problem is emphasized. The course also includes an introduction to the design, analysis, and optimization of mixture problems, which occur frequently in food manufacturing, metallurgy, and semiconductor manufacturing. The practical aspects of RSM are considered through a final project in which the students optimize a (simulated) manufacturing process. For this purpose, a Web-based process simulator has been designed. The Software packages Design Expert, SAS, and Minitab will be used by the students in the class. MATLAB and MAPLE programs will support some of the topics in the class. Recent papers from the technical literature will be covered. The prerequisites of this course are either IE 511, which is an introductory course in Design of Experiments, or STAT 501, an introductory course to linear regression.

Prerequisite: IE 511 or STAT 501

IE 584: Time Series Control and Process Adjustment

3 Credits

Design of Time Series-based process controllers for Quality Engineering. Study of the effect of autocorrelation on control chart performance. IE 584 Time Series Control & Process Adjustment (3) With modern sensor technology, quality control data frequently exhibits dynamics due to the short time between observations. Quality specifications keep "shrinking", and process drift is less tolerated than before. Under these circumstances, Statistical Process Control (SPC) techniques cannot be applied, and the emphasis in quality control moves from monitoring a process to actively adjusting it. Time Series techniques are ideal tools for developing such process adjustment strategies. This course covers topics of recent interest both in academia and in industry, including: integration of feedback adjustment techniques with traditional SPC methods; the "run-to-run" control problem as it occurs in discrete-part manufacturing (e.g., semiconductors); and optimal design of proportional-integral and EWMA controllers. In addition, a detailed treatment of statistical identification and estimation of ARIMA and discrete-time transfer function processes is presented. The effect of data autocorrelation on the performance of SPC control charts is discussed, and process adjustment strategies are presented as an alternative. For this reason, ABIMA modeling is discussed in detail as a means to represent data autocorrelation. Use of the MATLAB and SAS software packages are encouraged. A book on the course subject matter is under preparation and has been accepted by John Wiley & Sons who will publish it in its Probability & Statistics Series. Given the heterogeneity of the students taking the course, the prerequisites are rather modest, and the course is almost self-contained. The prerequisite is IE 423, or a similar introductory course in statistical process control.

IE 585: Convex Optimization

3 Credits

This course is designed to provide students with necessary skills to recognize or build convex optimization problems coming from diverse application areas and to solve them efficiently. It consists of five parts: 1) convex sets, 2) convex functions, 3) convex optimization, 4) algorithms and 5) real life applications. In the first part, important examples of convex sets will be given and the operations that preserve convexity of sets will be discussed. The second part will focus on convex functions, their basic properties, and the operations that preserve convexity

of functions. In the third part, which is built on the first two parts, convex optimization problems will be formally introduced along with important examples ranging from linear and quadratic to semi-definite programming; second, Lagrange duality and optimality conditions will be covered. The fourth part will focus on the algorithms to solve convex problems and on their computational complexity. In the fifth part, various applications will be covered.

Prerequisite: IE 505

Cross-listed with: EE 585

IE 586: Machining Process Design and Theory

3 Credits/Maximum of 999

Machining process engineering, including process design, computer programming and control, metal cutting theory, and process analysis. Machining processes are used to either directly or indirectly create the functional surfaces of nearly all mechanical products in use. This "hands on" course provides a comprehensive study of machining process engineering, including machine tool technology, machining processes, process design specification, basic and advanced machine programming, machine tool set up and specification, metal cutting mechanics and heat transfer, cutting tool wear mechanisms, workpiece surface formation mechanisms, and cutting tool materials and coatings. Students will learn through both lecture and laboratory. Students will use computer controlled machining centers and turning centers for training, scientific experiments, and projects. This course is intended for engineers who wish to implement and optimize machining processes in industry. In order to be successful in this course, students should have completed undergraduate courses in manufacturing process, materials engineering, and mechanical design. Students who successfully complete this course will obtain sufficient skills to engineer and utilize CNC machining processes. They will understand the relevant scientific theory and advanced engineering analysis that is currently being used to advance the technology. They will also be prepared for further graduate studies in product design and manufacture.

IE 587: Nano and Nanocomposite Manufacturing

3 Credits

This is an advanced graduate course on nanomanufacturing and nanocomposite manufacturing, which explores the design and manufacturing of nanomaterials and nanocomposites, hierarchical structures, and functional devices. In particular, it focuses on the studies of different top-down and bottom-up approaches/processes and the process-structure-property correlations. Students will study the interaction forces between nanoscale building blocks to understand process physics. Based on the fundamental understanding, students will know how to manipulate various interaction forces (e.g., chemical bonds, intermolecular forces) and interfaces to regulate the properties and functions of manufactured macroscopic forms. Furthermore, students will be exposed to cutting-edge research in the field by studying the current literature and conducting hands-on projects.

Recommended Preparation: CHEM 110 Chemical Principles; or PHYS 211 General Physics: Mechanics; Student should know the basic knowledge of atom structures, chemical bonds, crystal structures, defects, intermolecular forces and etc.

IE 588: Nonlinear Networks

3 Credits

Foundation in congestion games, including elements of non-cooperative game theory, equilibrium network flows, Braess paradox, and the price of anarchy. IE 588 Nonlinear Networks (3) This course examines the theory of congestion games, developed originally to describe flows on congested transport networks but recently embraced to model data networks. Students will learn how to formulate descriptive models of traffic and data network flows in the presence of congestion as Nash games expressed as variational inequalities (VIs). These models will be used to derive theoretical bounds on the price of anarchy (the social costs of not achieving a truly cooperative or system optimal flow). Students will also learn how to formulate normative network design problems and Stackelberg games or so-called mathematical programs with equilibrium constraints (MPECs) to avoid the Braess paradox. Numerical techniques for solving VIs and MPECs will be discussed and illustrated. The course begins with an introduction to so-called system optimal network flow models that explicitly incorporate network congestion. The study of system optimal flows contains an introduction to nonlinear network optimization algorithms, including feasible direction, gradient projection, simplicial decomposition and affine scaling algorithms. Following the consideration of system optimal flows, both atomic and non-atomic network equilibrium models in the form of non-cooperative Nash games are discussed in-depth. The price of anarchy is presented as the ratio of the cost of Nash equilibrium flows to the cost of system optimal flows within the network of interest. Various theoretical bounds on the price of anarchy are derived. Numerical experiments to determine the price of anarchy are also described. The Braess paradox, wherein global congestion can increase when local capacity is added to a nonlinear network, is introduced and its relationship to the price of anarchy demonstrated. Discrete and continuous equilibrium network design models that eliminate any possibility for the Braess paradox to arise are articulated. Each such design model is shown to be equivalent to a Stackelberg game, which is a type of mathematical program with equilibrium constraints (MPEC). Mechanism design in the form of network congestion pricing to alleviate the effects of congestion is also considered and shown to have an MPEC structure as well. Algorithms for solving MPECs to ascertain efficient network topology/efficient tolling will be discussed in detail, including simulated annealing and other types of computational intelligence on the one hand; and duality, penalty, decomposition and other types of nonlinear programming algorithms on the other. Students interested in taking this course should have completed a course in linear programming (IE 505); a course in nonlinear programming is also recommended.

Prerequisite: IE 505

IE 589: Dynamic Optimization and Differential Games

3 Credits

Dynamic optimization and dynamic non-cooperative games emphasizing industrial applications. IE 589 Dynamic Optimization and Differential Games (3) This course provides an introduction to dynamic optimization and dynamic noncooperative games from the perspective of infinite dimensional mathematical programming and differential variational inequalities in topological vector spaces. The objective of this course is to give a working knowledge of computational methods for and applications of dynamic games. It builds on two prerequisite courses - introduction to operations research and linear programming - and also on co-requisite course in non linear programming. Coverage includes

descent, projection and penalty algorithms for infinite dimensional mathematical programming and their extension to differential variational inequalities and dynamic games. Cournot-Nash-Bertrand and Stackelberg dynamic games are then studied from the point of view of differential variational inequalities and optimal control problems constrained by differential variational inequalities. Manufacturing and service engineering applications are employed to illustrate the tools developed in the course. Students will be evaluated on the basis of a set of assigned problems (30%), a semester paper (30%), and a final examination (40%).

Prerequisite: I E 425 and I E 505; Concurrent: I E 521

IE 590: I E Colloquium

1-3 Credits/Maximum of 3

Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

Prerequisite: graduate standing in Industrial Engineering

IE 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

IE 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given infrequently to explore, in depth, a comparatively narrow subject which may be topical or of special interest.

IE 598: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

IE 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

IE 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

IE 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

IE 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

IE 894: Capstone Design

3 Credits

Students will apply the analytical and design skills learned in previous courses to solve an industrial problem based on their workplace or industrial partner. Students who do not have an identifiable work-related problem will work collaboratively with the instructor to develop a suitable topic. This is an individual project culminating in a final report.

Recommended preparations: Recommended preparation is for the student to take this course after taking most of the courses in the program because prior knowledge is needed to perform a capstone design project.

Industrial Health and Safety (IHS)

IHS 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses. I H S 596 Individual Studies (1-9) This course is designed to allow students to study independent topics with industrial health and safety faculty. Grades will be assigned by the instructor according to a format agreed upon at the beginning of the period of study.

IHS 600: Thesis Research

1-15 Credits/Maximum of 999

No description. I H S 600 Thesis Research (1-6) This course comprises the I H S M.S. research project. Grades will be assigned by the instructor according to a format agreed upon at the beginning of the period of study.

Information Science (INSC)

INSC 521: Database Design Concepts

3 Credits

The requirements capture, design, and development of relational database applications; analysis of business requirements and development of appropriate database systems.

Prerequisite: completion of all IN SC or SWENG core courses or with instructor or division approval

INSC 525: Applied Data Mining

3 Credits

Functional overviews of algorithms used in data mining will be presented and contemporary data mining software used to conduct a project.

Prerequisite: SC&IS535 or with instructor or division approval

INSC 526: Business Process Management and Integration

3 Credits

Design and development of business processes that align business objectives with Information Technology (IT) systems.

INSC 531: Information Technology Law

3 Credits

Examines the legal concepts/issues applicable to the field of information technology and to information technology, software engineering, and computer professionals.

Prerequisite: completion of all IN SC core courses or with instructor or division approval

INSC 539: Information Science Emerging Topics

3 Credits

Computing and network technologies are constantly changing. However, they must be well adopted to help transform enterprise information systems to better support business operations and management. This course will explore various emerging theories and technologies in information science, including at least cloud computing, mobile application, Internet of things, blockchain, machine learning, and artificial intelligence. Students will learn how the emerging theories and technologies can be applied to addressing the weakness of legacy enterprise information systems in which the emerging technologies are not employed yet.

Prerequisite: taken as the final course in the Master of Science in Information Science degree, or with instructor's permission

INSC 561: Web Security and Privacy

3 Credits

A web-centric look at the latest techniques and practices in computer security as they apply to the Internet.

Prerequisite: CSE 543 or IST 815

INSC 594: Research Topics

1-15 Credits/Maximum of 15

Supervised student activities on research projects identified on an individual or small-group basis.

INSC 831: Contemporary Information Systems Architecture

3 Credits

Computing and network technologies are constantly changing and must be adopted appropriately to help transform enterprise information systems that better support business operations and management. This course will investigate the evolution of information systems architecture. Students will learn to employ contemporary information systems architecture to enhance IT support for business operations and management in organizations. Students will explore contemporary information systems architecture from different perspectives, including perspectives in technology, business operations, and management.

INSC 846: Network and Predictive Analytics for Socio-Technical Systems

3 Credits

The objective of this course is to provide a foundation in the principles of network and predictive analytics along with hands-on experience with statistical analysis software for studying the interrelatedness of cyber-social and cyber-technical aspects of our society as a whole

that have transformed physical communities into virtual communities. Fundamental principles of network and predictive analytics, the importance of studying network structures, and how network structures can facilitate communication, coordination and cooperation will be discussed. Statistical analysis software will be used for analyzing the structure of an organization or a society as whole to detect and capture the dynamic patterns of group membership and structure, and predict threats, attacks, criminal behavior and evolution of criminal networks.

Cross-listed with: DAAN 846

INSC 897: Special Topics

1-9 Credits/Maximum of 999

Formal courses given on a topical or special interest subject which may be offered infrequently.

Information Sciences and Technology (IST)

IST 501: Interdisciplinary Research Design for Information Sciences and Technology

3 Credits

An interdisciplinary introduction to graduate research design for investigating how data and information technologies are created, analyzed, and evaluated. IST 501 serves as the central foundational course for graduate students who intend to conduct research in IST. Although each student may eventually focus on one or several methods discussed in the course, the College is committed to providing all of its research students an interdisciplinary mindset regarding their own and their peers' research activities. This mindset is a defining feature of IST research training. The course provides foundational information regarding three contrasting research perspectives of IST: Social Informatics, Human-Centered Design and Computational Informatics. The three perspectives are presented in an interleaved fashion, one week at a time, with gradually increasing complexity and sophistication in the methods used. The methods address requirements for, design of, and impacts of information technologies used to meet people's information needs at multiple levels of analysis, including individuals, groups, organizations, and national and global cultures. The technologies investigated are of various types, including algorithms, structured data, user interfaces, and distributed systems. Each one-week methods topic is practiced through an individual homework activity and a team project is used to provide an integrated application activity that cumulates throughout the semester. Through reading of contemporary and classic literature, demonstrations and practice with specific research techniques, and sharing and reflection on individual and team research activities, students will explore fundamental assumptions, theories and directions in contemporary research design useful to researchers in IST. The emphasis of this course is on defining and developing conceptual linkages between human behavior, the social, organizational, and cultural context of information and technology use, human experience when learning or using information and computing technologies, and the construction of information and computing technologies. The interdisciplinary research design will operate at individual, group, and other units of human, social, and organizational analysis, and across a range of information technologies.

IST 503: Foundations for IST Research

3 Credits

Study of major methodological, normative, and theoretical issues in philosophy of science related to research in information sciences and technology. IST 503 Foundations for IST Research (3) This course is a study of major methodological, normative, and theoretical issues in the philosophy of science related to research in information science and technology. A significant part of this course will involve coordinating issues and problems customarily associated with the philosophy of science in general with current research in information science and technology (IST) in particular. In order to achieve this coordination, the study of classical texts in the philosophy of science will be interspersed at appropriate places with lectures and topics that exhibit relevant faculty research in various IST related disciplines. The course focuses on the main arguments that have been advanced in Anglo-American philosophy of the science for the period beginning about seventy years ago up to the present. The course contradicts the view of a single unitary "philosophy of science." It shows a series of positions and arguments that continue to lead on to still deeper questions. Usually the student will have adopted one of the classical positions without having examined it or defended it rigorously. Readings will progress in a historical fashion through arguments that attempt to provide a justification for the truth claims of science. The course will begin with a consideration of logical positivism in its early forms, i.e. the ideas of the Vienna Circle, and the early Wittgenstein's theory of meaning. The course will go on to the writings of Karl Popper especially as found in his *Logic of Scientific Discovery*. Continuing the historical development, Kuhn's "The Structure of Scientific Revolutions" will be considered. The discussion will then progress to the Popper-Kuhn debates involving the sophisticated falsificationists (Lakatos) and eclectic approaches like Feyerabend's. Finally, Richard Bernstein's book, *Beyond Objectivism and Relativism* is reviewed summarizing the debate. This final view strives to uncover the strong points in the opposing positions reviewed early in the course. Then it sets a hermeneutical position which he derives principally from the philosophy of Hans Georg Gadamer. This position amounts to a new and interesting view on how knowledge is attained in science and in life in general. The course relates the debates in the arguments in the philosophy of science to research issues in IST.

Concurrent: IST 501

IST 504: Foundations of Theories and Methods of Information Sciences and Technology Research

3 Credits

Provides the foundation to the research and theories of how technologies are used to meet society's, groups' and individuals' information needs. IST 504 Foundations of Theories and Methods of Information Sciences and Technology Research (3) This course provides an overview of the diverse fields that comprise the information sciences. The course has three broad objectives. First, the course serves as an overview to the theories, models, findings, research methods and research-related issues that frame the multiple fields of the information sciences. Second, the course provides students with skills of critical evaluation of literature. Finally, the course provides students a means to begin formulating researchable topics and questions. The course is designed as a fundamental course for research-oriented graduate students in the information sciences. The specific focus is a critical treatment of the research relative to the questions asked, views of a technology's affordances and potential uses, the implementation of the research,

and conclusions drawn. Through reading of contemporary and classic literature, ongoing debate, reflection and synthesis, and active analyses, students will explore fundamental assumptions, theories and directions in the contemporary research in the various fields of the information sciences. The emphasis of this course is on defining and developing conceptual linkages between human and social behavior, information and the use of computing technologies. Assessments will be based on a number of short summary papers and an extensive synthesis of literature organized around a conceptual framework. Because this is an interdisciplinary subject, students should be prepared to read outside their primary research/interest area and be ready to embrace and integrate new knowledge from related fields into their primary field.

IST 505: Foundations of Research Design in Information Sciences and Technology

3 Credits

Provides the foundations on research design and methods used in information sciences and technology. IST 505 Foundations of Research Design in Information Sciences and Technology (3) This course develops students' abilities to conduct academic research, formulate a relevant thesis proposal, present and discuss the progress of their work, and conduct a small-scale research project in an information sciences and technology-related area. It provides an overview of the major research methods used in the area of information sciences and technology, including quantitative, qualitative, computational, and design approaches. The course emphasizes developing and practicing research design, execution, evaluation, and writing skills through application of the concepts that define the course.

Prerequisite: IST 504

IST 510: Foundations in Computational Informatics

3 Credits

Foundational theories and techniques in general computational informatics.

Prerequisite: IST 501

IST 511: Information Management: Information and Technology

3 Credits

Introduction to theoretical, computational, and practical issues involved in managing textual, spatial, temporal, and multimedia information in a computerized system. IST 511 Information Management: Information and Technology (3) The objective of IST 511 is to provide an introduction to the theoretical and computational issues involved in managing textual, spatial, temporal, and multimedia information. The course will survey the nature of information in various application contexts (digital libraries, digital government, healthcare information, environmental information, etc) and seek to understand their generic and specific requirements for information management. Students will be exposed to major principles and technologies for information management that are drawn from database systems, and information retrieval (IR) and spatial/geographical information systems literature. Special emphasis will be given to the problems of managing heterogeneous information sources with different ontology, representation, scales, and error characteristics. This course is required of all Information Sciences and Technology (IST) graduate students under both research Master and Ph.D. degrees. It is a foundation course that should be taken in the first or second year of graduate study. IST 501 is the prerequisite for this course. For hands-

on practice and demonstration purposes, this course requires student access and use of a database management system (such as ORACLE or SQL server), a geographical information systems (Arc View or MapInfo), a information retrieval system, and/or a ERP (Enterprise Resource Planning) system.

Prerequisite: IST 501

IST 520: Foundations in Human-Centered Design

3 Credits

Foundational theories in Human-Centered Interactions used for Human-Centered Design.

Prerequisite: IST 501

IST 521: Human-Computer Interaction: The User and Technology

3 Credits

Users, models of users, developing the models, technology for creating interfaces; examples of good research and implications for Human-Computer Interface (HCI) design. IST 521 Human-Computer Interaction: The User and Technology (3) This course introduces students to the broad area of human-computer interaction and the idea of a theory driven interface, an underlying concept in HCI. To do this, the course starts by outlining relevant aspects of human behavior with respect to technology and how interfaces are developed, the two raw components. Students are then exposed to a tool for creating interfaces and a variety of theories of how users interact with technology on a variety of levels. These theories are validated and supplemented by usability studies. The course completes with a group project based on the readings and theories introduced in the first 12 weeks.

Prerequisite: IST 501

IST 525: Computer-Supported Cooperative Work

3 Credits

IST 525 introduces theories, empirical findings, evaluation methods, and design frameworks in computer-supported cooperative work. IST 525 Computer-Supported Cooperative Work (3) Students in the course will investigate CSCW challenges and opportunities from the dual perspectives of human-computer interaction and socio-technical systems analysis. They will analyze group interactions and concerns in collaborative activities such as written and spoken communication, design, meetings, education, decision-making, and everyday work activities. They will review and critique state-of-the-art CSCW technologies, including text-based and video communication tools, immersive meeting environments, group decision-making, workflow, and knowledge management. These technologies will provide a context for investigating and synthesizing issues related to individual use (e.g., perceptions of cost-benefit), the context of collaboration (e.g., social and cultural norms embodied in systems), and software architecture (e.g., coupling and consistency management). Students will apply their understanding of these issues in evaluation and design projects.

Prerequisite: IST 521

IST 526: Development Tools and Visualizations for Human-Computer Interaction

3 Credits

IST 526 addresses concepts and tools for developing working user interface software and prototypes to provide effective information visualizations. IST 526 Development Tools and Visualizations for Human Computer Interaction (3) This is a technical course focused on the different tools for designing and creating working software for the human-computer interface to complex systems. The course builds on the psychological and social theories, usability engineering methods, and computer programming techniques from its prerequisite courses to provide an advanced experience with user interface design and construction. Because of their importance and depth, special consideration is given to the concepts and tools used to develop sophisticated visualizations of complex information.

Prerequisite: IST 521

IST 530: Foundations in Social Informatics

3 Credits

Foundations in social theories used in the study of the human context within which information and information technology exists.

Prerequisite: IST 501

IST 541: Qualitative Research in Information Sciences and Technology

3 Credits

Assists IST researchers in their efforts to learn about and employ appropriate qualitative methods in their research. IST 541 Qualitative Research in Information Sciences and Technology (3) As information and communication technologies (ICTs) have evolved, so too has our understanding of the role of the human contexts within which information technologies are situated. This has led to the need for appropriate methods of studying information systems and technologies in their context of use. There is a growing consensus that qualitative methods offer important research opportunities for this type of study. Therefore, researchers in such fields as the information sciences and technologies, communication technologies and information systems should have an understanding of the various types of qualitative methods so that they can determine ones that are most appropriate for addressing their particular research problems. The course is complementary to quantitative methods courses, in that it addresses problems that are not amenable to those approaches. For example, studies involving very small groups, individuals, societal level concepts and others often lend themselves to qualitative research techniques. This course begins by considering research topics that lend themselves to the choice of qualitative research methods. It then proceeds to examine the steps involved in conducting qualitative research. These include: developing the research question(s); choosing a particular research method (such as ethnography, case study or action research); making decisions about approaches to data collection (such as interview or focus group) and analysis (such as coding technique); and producing and publishing the results. This course explores concrete issues that researchers have encountered in their use of qualitative methods. It does this by drawing upon the collective expertise of distinguished scholars who employ qualitative methods in their own research. The course will examine published work that focuses on research findings as well as that which discusses methodological issues.

Prerequisite: IST 501

IST 543: Foundations of Software Security

3 Credits

This course teaches the principles and practice of software security. The course gives an overview of the foundations of computation models and languages. It then builds on this foundation by teaching students how to address software security issues using fundamental techniques such as type systems and program analysis. The course also covers the practical side of software security, such as memory safety issues including buffer overflow, code injection, and code reuse attacks, as well as some of the latest security problems. Through this course, the students will gain a concrete understanding of principles and practices of software security and be prepared for research on software security related problems.

IST 554: Network Management and Security

3 Credits

Essential skills and knowledge for effectively utilizing networks and Internet technologies to facilitate, manage and secure data communications and applications. IST 554 Network Management and Security (3) Information technology is an integral part of today's organizations and services. As information systems and networks continue to grow and evolve we are becoming more and more dependent, individually and socially, on them to provide support for the economy, military, education and business. Because of this dependence, network-based information and communication systems are attractive targets for those who would compromise information or disrupt services for economic, social or political purposes.

IST 555: Intelligent Agents and Distributed Decision Making

3 Credits

Distributed decision making theories and agent-based technologies, models and systems with applications in command and control, emergency and resource management. IST 555 Intelligent Agents and Distributed Decision Making (3) This course introduces the theory and design of intelligent agents for distributed decision making with applications in grid computing, command and control, emergency management and sensor management. Emphasis will be placed on understanding theories of decision making and using them to model and build relevant agent-based distributed systems for supporting decision making.

IST 557: Data Mining: Techniques and Applications

3 Credits

This course will introduce data mining techniques, including frequent pattern and association rule mining, some basic background on classification and clustering, and applications of data mining techniques in specific domains. The emphasis will be on applications in specific domains rather than fundamental methodologies. IST 557 Data Mining: Techniques and Applications (3) The course will begin with an introduction of data mining field, including why data mining, what is data mining, what kinds of data can be mined, what kinds of patterns can be mined, an overview of technologies, the major issues in data mining, and a brief history of data mining community. The three key lecture topics are: (1) mining frequent patterns and association rules; (2) classification: basic concepts and techniques, and (3) cluster analysis: basic concepts. For topic (1), we will introduce frequent item set mining

methods including Apriori and FPGrowth. We will also teach advanced frequent pattern mining methods such as pattern mining in multi-dimensional space, constraint-based frequent pattern mining, mining high-dimensional data, sequential pattern mining, and graph pattern mining. For topic (2), we will teach how to formulate a real-world problem into a classification problem, how to apply classification models on real data and how to analyze the results. The classification models covered in our class include decision tree, random forest, boosting, support vector machine and kernels, naive bayes classifier, and KNN. Students will learn how to evaluate classification methods using different measures. We will be brief on the fundamental classification methods and will focus more on the applications of such methods on various kinds of data. For topic (3), we will cover the clustering topics including partitioning methods, hierarchical methods, density-based methods, grid-based methods and evaluation of clustering results. We will be brief on the fundamental clustering methods and will focus more on the applications of such methods on various kinds of data. Four weeks will be used for lectures on special topics such as text mining, time series mining, spatial data mining, graph mining, image mining, and emerging subjects in data mining. The purpose of the special topics is to help students learn about real-world data mining problems and applying state-of-the-art solutions to them. Instructor will select a few topics based on students' project proposals. Instructor and students will work together on the literature survey and prepare for the presentation. Potential key special topics include: Mining text data. We will introduce basic preprocessing methods such as tokenization, stemming, and stopwords filtering and basic textual features such as tf-idf. We will teach text mining topics including sentiment analysis, topic modeling, and entity extraction. Mining temporal data. We will introduce basic techniques in mining temporal data, such as measuring time series similarity, periodicity analysis, and trend prediction. Mining spatial data. We will introduce basic spatial models, clustering of spatial locations, spatial outliers, co-location patterns, and location prediction. There will be five discussion classes. Instructor will use these classes to talk with individual students and teams, help them with the problems they encounter in assignments and projects, and better personalize the learning experience.

Prerequisite: Programming, Data Structures, Algorithms, Basic Statistics

IST 558: Data Mining II

3 Credits

Advanced data mining techniques: temporal pattern mining, network mining, boosting, discriminative models, generative models, data warehouse, and choosing mining algorithms. IST (STAT) 558 Data Mining II (3) This course is the second course in a two-course sequence on data mining. It emphasizes advanced concepts and techniques for data mining and their application to large-scale data warehouse. Building on the statistical foundations and underpinnings of data mining introduced in Data Mining I, this course covers advanced topics on data mining; mining association rules from large-scale data warehouse, hierarchical clustering, mining patterns from temporal data, semi-supervised learning, active learning and boosting. In addition, to computational aspects of algorithm implementation, the course will also cover architecture and implementation of data warehouse, data preprocessing (including data cleansing), and the choice of mining algorithms for applications. In addition to discriminative models such as CRF and SVM models, the course will also introduce generative models such as Bayesian Net and LDA. A term project will be developed by each student to apply an advanced data mining algorithm to a multi-dimensional data set. Classes will include lectures, paper discussions, and project presentations. Paper discussions will allow students to discuss state-of-the-art literature

related to data mining. Project presentations will enable students to share and compare project ideas with each other and to receive feedback from the instructor.

Prerequisite: STAT 557 or IST 557

Cross-listed with: STAT 558

IST 561: Data Mining Driven Design

3 Credits

The study and application of data mining/machine learning (DM/ML) techniques in multidisciplinary design. CSE 561 / EDSGN 561 / IE 561 / IST 561 Data Mining Driven Design (3) This course examines how theoretical data mining/machine learning (DM/ML) algorithms can be employed to solve large-scale, complex design problems. Knowledge Discovery in Databases (KDD) is the umbrella term used to describe the sequential steps involved in capturing and discovering hidden, previously unknown knowledge in large databases. The course begins with foundational information regarding engineering design and provides an overview of KDD and the emergence of the digital age. Students will investigate data acquisition and storage techniques where they will learn the difference between stated and revealed data as related to design. Students will construct their own databases and learn essential techniques in data base queries (SQL) and management. Data transformation techniques, such as binning and dimensionality reduction, will be examined in the data transformation section of the course. This course has a design-driven focus, which will enable students to solve real-life design challenges spanning diverse domains. Students will work on project-based exercises aimed at proposing novel data mining algorithms, or employing existing algorithms to solve design problems in fields relating to engineering, healthcare, financial markets, military systems, to name a few. Data visualization techniques will also be studied to help communicate complex data mining models in a timely and efficient manner.

Cross-listed with: CSE 561, EDSGN 561, IE 561

IST 562: Theoretical Foundations of Information Science

3 Credits

This course introduces the theoretical foundations of information science, with applications in communication, signal processing, machine learning, and pattern recognition. IST 562 Theoretical Foundations of Information Science (3) This course introduces the theoretical foundations of information science, with applications in communication, signal processing, machine learning, and pattern recognition. Emphases will be placed on theories of communications and compression. Theories of probabilities and inference, learning methodologies, and graph theory.

Prerequisite: Familiarity with college-level linear algebra, calculus, and probability theory or consent of the instructor

IST 564: Crisis, Disaster and Risk Management

3 Credits

This course examines the fundamental elements of crisis, disaster, risk and emergency management.

IST 574: Human Language Technologies

3 Credits

This course provides students with tools and techniques for processing and extracting meaning and knowledge from a large volume of text data, with a focus on applying contemporary research findings in human language technologies. The course begins with a brief overview of human language technologies (HLT), with the goal of covering the foundations of HLT to students with a diverse background. The course then covers three topics of contemporary interest in human language technologies: sentiment analysis, computational semantics, and computational discourse. Students will evaluate and compare ideas from recent research.

Recommended Preparations: Machine learning, probability and statistics, Python or Java

IST 577: Human Factors of Security and Privacy

3 Credits

The ubiquity of computing systems and information technology has made security and privacy become a central issue in the "information age." More and more evidence revealed that technology alone is not sufficient to solve security and privacy problems. Humans are often thought of as "the weakest link in the chain of various security and privacy issues." Thus, it is essential for security and privacy experts to have an understanding of the human factors of security and privacy, e.g., how people will interact with the systems they develop. This course is designed to provide students an overview of the theoretical foundations and empirical findings of human factors of security and privacy and give them experience in understanding and designing studies aimed at helping evaluate usability and user-interface issues in security and privacy systems. The course is suitable for students interested in privacy and security who would like to learn more about the human aspects, and for students interested in human factors/HCI who would like to learn more about security and privacy.

Recommended Preparations: IST 501; IST 504

IST 584: Cyber Simulation Event and Analysis

3 Credits

Students apply theoretical skills and knowledge to critically assess solutions to "real world" Cybersecurity problems. This course combines synthesis and analysis of responses to Cybersecurity event simulations with critical thinking to resolve and extend solutions. Students conduct a series of laboratory assignment milestones. Each milestone generates a recommended literature-based resolution (i.e., tools, techniques, and methodologies) to prevent and control real world Cybersecurity attacks. Peer review exposes students to alternative exercise solutions, permitting a critical reflection. Analysis of each milestone is documented and compiled to create a final portfolio of lessons learned, along with new and emerging theoretical responses to the simulated Cybersecurity events. Each milestone in the final portfolio emphasizes literature-based research reflection, enabling the student to expand the frontiers of knowledge through creation of a final scholarly work product.

Prerequisite: IST 554, IST 815, IST 820

IST 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

IST 594: Research Topics

1-18 Credits/Maximum of 18

Supervised student activities on research projects identified on an individual or small group basis.

IST 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

IST 597: Special Topics

1-9 Credits/Maximum of 999

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

IST 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

IST 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

IST 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

No description.

IST 610: Thesis Research Off-Campus

1-15 Credits/Maximum of 999

No description.

IST 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

IST 803: Cybersecurity Foundations

3 Credits

This graduate course builds foundational knowledge in students new to cybersecurity. This course covers operating systems, cybersecurity (OSI Model, TCP/IP suite, hardware, etc.), networking, database, and cloud concepts, as well as topics in security, risk, analysis, and cybersecurity.

IST 805: Cybersecurity Forensics and Management

3 Credits

This graduate course improves understanding in an organizational setting of the principles and practices of cyber forensics as well as the management of information security. Foundational Cybersecurity forensic software and hardware analyses is accompanied by information security management in an organization. Conducting basic Windows and Linux computer forensic investigative processes, discussion, analysis, and legal aspects are covered in the first part of the course. The second part of the course covers various information security functions of an organization such as laws, ethics, planning, governance, risk management, policy creation, crisis, and incidence response.

IST 815: Foundations of Information Security and Assurance

3 Credits

This course provides theoretical and applied foundations of information security and assurance. IST 815 Foundations of Information Security and Assurance (3) IST 815 provides theoretical and applied foundations of information security and assurance, with an emphasis on access control, information security governance and risk management, cryptography, security architecture and design, software security, business continuity and disaster recovery planning, network security, physical security, operations security, laws, regulations, investigations, and compliance.

IST 816: Web Fundamentals

3 Credits

The growth and use of the web is increasing at a remarkable rate. The web is a huge evolving system with data full of uncertainties and has become a critical part of everyday life of modern societies. This course will cover fundamental techniques used in building and maintaining the web. The focus will be on the practical aspect of the web's backbone techniques. Topics to be covered include: basic web and internet technologies, modern applications based on the web techniques, and an integrated presentation of theory, examples, exercises, and applications.

IST 820: Cybersecurity Analytics

3 Credits

IST 820 provides theoretical and applied foundations of fundamentals of network security, data sources, data collection techniques and tools, cybersecurity analytics infrastructure, machine learning and data mining, network forensics, anomaly and malware detection, security data visualization, and security dashboard design and implementation.

IST 821: Cloud Cybersecurity

3 Credits

This graduate level course provides students with a foundation in Cloud Computing including its supporting network infrastructure. Key parts of this type of infrastructure are examined with respect to their vulnerabilities. The focus of the class addresses inherent cyber vulnerabilities in cloud computing. Approaches and techniques for securing data, hardware and software in the cloud are then discussed. Finally, topics such as disaster recovery and deployment models are explored.

Recommended Preparation: IST 815 and IST 820 and IST 554

IST 825: Technologies for Web and E-Commerce Application Security

3 Credits

This course provides an overview of techniques to assess and ensure the security of web applications and services that drive modern e-commerce transactions. The course first presents foundational knowledge of security technologies, web servers, web applications, and web services. Building on this foundational knowledge, various code review and testing techniques to identify and evaluate vulnerabilities in web applications, web services, and databases are covered through comprehensive hands-on exercises. Besides, the best practices to prevent common flaws, misconfigurations, and vulnerabilities in web applications and services are discussed. The course emphasizes threat modeling as a critical security evaluation approach of web applications and services.

IST 830: Cybersecurity Project Management

3 Credits

This course provides students with the principles of project management and knowledge of the project management skills and processes needed to select, initiate, and plan a project. Students will employ various elements of the project management process, software, tools and techniques in a complex cybersecurity environment. In addition to learning basic project management topics, including creating the project charter, developing project scope statements, creating the project schedule and budget, assigning project resources, and risk planning, students will explore more advanced topics in the area of cybersecurity project management, including cybersecurity risk management and assessment and agile project management. Students will learn the sophisticated techniques and management designs used to effectively manage risk and uncertainty, financial exposure and human constraints.

Recommended Preparations: Students taking this course are expected to be familiar with cybersecurity concepts.

IST 836: Healthcare Informatics

3 Credits

This course provides a foundation in information systems and technology for improvement of healthcare.

Cross-listed with: NURS 836

IST 841: Search Engines & Information Retrieval

3 Credits

Introductory course on search engines and information retrieval. Search, indexing, ranking, and search evaluation are formally defined, explained, and used. IST 841 Search Engines & Information Retrieval (3) This is introductory course on the principles of information storage and retrieval systems and databases. Students will learn how effective information search and retrieval is interrelated with the organization and description of information to be retrieved. Students will also learn to use a set of open source tools and procedures for organizing information, will become familiar with the techniques involved in conducting effective searches of print and online information resources and will build a vertical/specialty search engine. Search, indexing, ranking, and search evaluation are formally defined, explained and used.

IST 852: Knowledge Management

3 Credits/Maximum of 999

This course provides a foundation in knowledge management concepts and paradigms, emphasizing computational methodologies and tools for supporting data and knowledge management practices.

IST 866: Threat Hunting and Offensive Cybersecurity

3 Credits

This course focuses both on monitoring systems and networks for real-time threats and on "ethical" hacking tools and techniques. Both topics allow students to recognize the need for the constant collection and analysis of Cybersecurity data and provide the insight on how to accomplish such. Students in the first part of the course practice techniques, and put into use various tools, for identifying Cybersecurity threats. Students in the second part of the course test systems, networks, and policies for vulnerabilities and exploit them while recognizing how to prevent such real attacks from hackers.

Prerequisite: IST 554 and IST 815

IST 868: Applied Visual Analytics

3 Credits

This course covers the fundamental principles, methods, and tools of visual analytics that enable data and security analysts to synthesize information and derive insight from data. When dealing with complex decisions, analysts are faced with a continuously growing set of data originating from a wide range of sources and in a wide variety of formats. Such data needs to be analyzed to characterize a situation and to take actions promptly. Visual Analytics (VA) represents a human-centered approach in designing interactive data visualizations and dashboards that enables full cycles of data analysis, from making sense of data, assessing situations, detecting unexpected patterns, as well as communicating findings and informing actions. The objective of this course is to introduce a set of data visualization and interaction methods that enhance the analytical skills of students in solving problems. Students will gain skills and knowledge in designing interactive visual dashboards that support analytical reasoning with data. Upon completion of this course, students should develop skills in (1) choosing proper data visualization methods (e.g., bar charts, line charts, tree maps, scatter plots, histograms, bullet charts) to reveal patterns in quantitative and categorical data; (2) designing visualization of spatial and temporal data for exploring geo-temporal patterns; (3) creating customizable and dynamic visualizations for exploratory data analysis; (4) creating interactive dashboards for investigative analysis; (5) applying visual analytic skills in applications such as detecting risk or threats in security investigation or monitoring pandemic spreads.

IST 885: Introduction to Multisensor Data Fusion

3 Credits

Understanding the concepts, techniques, and issues surrounding the fusion of information from multiple sensors and sources of data. IST 885 Introduction to Multisensor Data Fusion (3) Rapid advances in nano and micro-scale sensors, ubiquitous wide-band wireless communications and improvements in computing provide the opportunity to collect and disseminate huge amounts of data and information from sensors, humans acting as observers, and emerging data available on the web. Applications for this data are widespread and include areas such

as geospatial intelligence, emergency management, environmental monitoring, epidemiology, and others. This course introduces methods and process models for fusion of the information from diverse sources to achieve inferences that cannot be obtained by using a single source or sensor. Course Objectives: IST 885 provides an introduction to multisensor information fusion. Multisensor information fusion seeks to combine information from multiple sensors and sources to achieve inferences that are not feasible from a single sensor or source. the proliferation of micro and nano-scale sensors, wireless communication, and ubiquitous computing enables the assembly of information from sensors, models, and human input for a wide variety of applications such as environmental monitoring, crisis management, medical diagnosis, monitoring and control of manufacturing processes. Techniques for fusing multisensor and multi-source information are drawn from a variety of disciplines including statistics, data mining, artificial intelligence, estimation and control theory, pattern recognition, and signal and image processing. While this course is non-mathematical it will help students understand the concepts, techniques and issues associated with developing and using multisensor data fusion systems. At the end of this course students should be able to: * Explain different models of multisensor data fusion and describe the advantages and limitations of data fusion * Explain the five levels of data fusion in the Joint Directors of Laboratories (JDL) data fusion process model * Assess and characterize a sample information fusion application * Identify various techniques used in multisensor data fusion and indicate the applicability and limitations of the techniques for a selected application * Design a data fusion system including specifying the required functions, applicable techniques, selection/assessment of sensors and information sources, and design of a sample user interface * Discuss current technology trends that affect the implementation of a fusion system. Student activities: The course consists of ten lessons and one capstone group project that will span either the 15-week semester or the combined 12-week summer session. Each lesson will require approximately 8 hours of student activity. Student activities will include reading lesson text, online quizzes, and discussions about the way in which multisensor information fusion is applied to selected applications such as geospatial intelligence, environmental monitoring, monitoring of complex systems, crisis management or related areas.

IST 888: Mobile Computing and Applications

3 Credits

design and development of mobile computing-based applications and services utilizing current and emerging mobile computing technologies. The purpose of this course is to provide students with an advanced and hands-on exploration of mobile computing paradigms. Mobile computing addresses the mobility needs of business operations and management in organizations, with the increasing trend of leveraging a variety of deployed enterprise information systems. Hence, well-designed and developed mobile applications can meet the needs of business mobility on both the service provider and the customer sides. This course is designed to explore and discuss approaches to the design and development of mobile applications. It builds an awareness of the business need for operational agility and mobility, and the value of existing IT investments in organizations. Specifically, this course investigates the fundamental design and development of mobile applications and services using platform technologies; area topics include mobile application and services design patterns, user interface, animation, location & mapping, and integration. Through working on exercises, labs, and projects, students will be able to identify and apply appropriate mobile platform technologies in their assignments and will gain skills and coding experience in the development of adaptable and

sustainable mobile application solutions. Consequently, with this course, students will learn mobile development environments, application and service design and development, device emulators, data and mobility management, and enterprise solution-based integration. Cross Listings: IST 888 will be added as a cross-listed course.

Cross-listed with: SWENG 888

IST 894: Capstone Experience

3 Credits

This course is a laboratory-based course that requires students to apply skills and knowledge from previous coursework to "real world" cybersecurity scenarios and problems. The course combines analyses of cybersecurity issues with the critical thinking required to resolve them. Students will be faced with a variety of laboratory assignments spanning a wide range of cybersecurity vulnerabilities and scenarios they must deal with. Each module's laboratory assignment requires a thorough analysis in order to apply the proper tools and techniques for a successful resolution. Peer reviews of work ensure that students grow in their understanding of the skills involved for a given exercise and in their ability to judge alternate approaches to resolution.

Prerequisites: IST 554 and IST 815 and IST 820

IST 896: Individual Studies

1-9 Credits/Maximum of 9

Creative projects with a professional orientation, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal course.

IST 897: Special Topics

1-9 Credits

Forman courses given on a topical or special interest subject with a professional orientation that may be offered infrequently.

Information Systems - CA (INFSY)

INFSY 535: Object-Oriented Design and Programming in Business

3 Credits

Overview of key concepts in object design and the application of these concepts in business software development. INFSY 535 will be among the courses prescribed in the MSIS program and would normally be taken early in the Program. It is a prerequisite to several additional courses in the program. The course is intended to provide students with a foundation in object-oriented design and programming to understand the application of these concepts to business problems. Students will learn basic object concepts and develop skills to implement computer programs utilizing object tools. As managers in the technology environment, students need to have an understanding of how projects are implemented. To be successful, they also need to learn how to work together to design, implement, and manage technology projects. The goals of INFSY 535 are to: 1) Expose students to principles and concepts within the object oriented programming environment, 2) Teach students how to apply an object-oriented language in a business environment, and 3) Develop team skills when programming complex systems.

Prerequisite: admission to MBA or MSIS Program or Program approval

INFSY 540: Information Technology and Knowledge Management

3 Credits

Information systems management, enterprise models of information technology, information technology and knowledge management. INFSY 540 Information Technology and Knowledge Management (3) INFSY 540, Information Technology and Knowledge Management, is a required course for MBA and MSIS students. Students will be provided an understanding of enterprise resource planning and how it relates to information technology architecture and its impact on modern organizations. Students learn Information Technology and Knowledge Management concepts that may be applied to leverage the benefits, avoid the pitfalls, and overcome the limitations of using information technology in an organization. Although individual assignments and examinations will occur, INFSY 540 includes project- and team-based assignments where students will actively examine Information Technology and Knowledge Management and its effects on industries and specific organizations. Student performance will be evaluated using both individual and team assignments, individual examinations, case study analyses, and research papers.

Prerequisite: admission to M.B.A. or MS/IS program or program permission

INFSY 543: Electronic Commerce

3 Credits

Overview of key aspects of E-Commerce within an organizational context including coverage of managerial issues and supporting technology. INFSY 543 Introduction to E-Commerce (3) INFSY 543 provides a survey of E-Commerce topics, and serves as a foundation for further courses on E-commerce. The course is designed to appeal to both MBA and MSIS students. Upon successful completion of this course, the student will have an understanding of the various types of e-commerce, systems used to support e-commerce, applications of e-commerce, and associated managerial issues. INF SY 543 is an elective in the MBA and MSIS programs. INFSY 540, Information Resources in Management, is a required course for MBA and MSIS students and is a prerequisite for INFSY 543. In INFSY 543, students will continue to explore the interrelationship between technology and organizational performance. Although individual assignments and examinations will occur, INFSY 543 includes project- and team-based assignments where students will actively examine e-commerce and its effects on industries and specific organizations. Student performance will be evaluated using both individual and team assignments, individual examinations, case study analyses, and e-commerce project(s). INFSY 543 will be offered once per academic year or more frequently, based on student enrollment and demand.

Prerequisite: INFSY540 or permission of the Program

INFSY 547: WEB Enabled Technologies

3 Credits

Integrating design principles and applying technologies that support business related, web-based applications. INFSY 547 WEB Enabled Technologies (3) The objectives of this course are to: a) teach students how to manage large WEB projects b) teach students a programming language that is used to create complex business projects c) make students aware of research issues that apply to WEB development d) strengthen collaborative skills related to project development To

accomplish these goals, students will study project management as applied to WEB applications, participate collaboratively in a business project where they apply management and design skills over the course of the semester. Additionally, the latest research will be explored as it relates to the above.

Prerequisite: INFSY535 or permission of the Program

INFSY 554: Master's Project

3 Credits

Development of an original master's project in the student's field of interest and preparation of a paper.

Prerequisite: last 6 credits of Master's in the Information Systems program

INFSY 555: Data Management Systems

3 Credits

Concepts and theory of database management systems explored through data modeling and planning techniques. INFSY 555 Data Management systems (3) This course emphasizes the analysis, design and development of relational database management systems. Students will develop the analysis and design of a relational database for a business application through a series of assignments using ORACLE database software. Students also develop a research paper in database management.

Prerequisite: INFSY535

INFSY 556: Data Warehousing

3 Credits

The study of the requirements collection, design, and development of data warehouses. INFSY 556 Data Warehousing (3) This course deals with the collection of requirements, design, and development of data warehouses. Requirements gathering through query graphs, dimensional modeling, online analytical processing (OLAP) tools, metadata, and technical architecture of data warehouses will be the major focus of this course. End user applications pertaining to data warehousing is also included.

Prerequisite: INFSY555

INFSY 565: Intelligent Systems in Business

3 Credits

This course will emphasize the analysis, design, and application of intelligent systems within organizational settings. INFSY 565 Intelligent Systems in Business (3) This course emphasizes the analysis, design and application of intelligent systems within organizational settings. Students will study the underlying concepts of intelligent systems such as expert systems and neural networks and learn how these systems support the business environment. A goal of the course is that students learn when and where intelligent systems will benefit an organization. Students will analyze cases related to intelligent system development, study the issues of knowledge acquisition, and learn about uncertainty in intelligent systems. Actual system applications will be integrated into the course.

Prerequisite: INFSY535

INFSY 566: Data Mining and Knowledge Discovery

3 Credits

The study and application of data mining techniques used to mine patterns in large transactional databases. INFSY 566 Data Mining and Knowledge Discovery (3) This course deals with the advanced study of intelligent data mining tools that are used to mine patterns in very large databases. The focus is on theoretical, mathematical and statistical foundations of data mining as well as the applications of data mining to various business applications. Students taking this course will learn different data mining techniques that can be used to mine patterns in large corporate and transactional databases, will be capable of developing and applying data mining tools, and will be able to do independent research in data mining area. Specific topics include the process of and statistical perspectives on knowledge discovery in databases, graphical models for discovering knowledge, inductive logic programming and data mining, discovering informative patterns and data cleaning, fast mining of association rules, inductive and deductive reasoning for data mining, and mathematical foundations of data mining. Data mining applications in finance, direct marketing and medicine will be emphasized. Several projects and a research paper required.

Prerequisite: INFSY565

INFSY 570: Software Engineering in the Analysis and Design of Information Systems

3 Credits

Software engineering concepts, specifically the analysis and design of structured information systems using computer-aided software engineering (CASE).

Prerequisite: INFSY535

INFSY 572: Strategic Information Systems

3 Credits

The survival and success of organizations in a highly competitive on-demand economy is dependent on strategic information technology alignment. Strategic Information Systems examines the strategic management and use of information resources, theoretical models, and practices. It examines the alignment of an organization's business strategy, organizational strategy and design, and information systems strategy in order to achieve a sustainable competitive advantage.

INFSY 575: Seminar in Information Technology Management

3 Credits

Examination of selected topics relevant to current and future managerial and organizational issues of information technology.

Prerequisite: INFSY555 or INFSY570

INFSY 587: Global Information Technology

3 Credits

Comprehensive coverage of components, applications, and issues of global information technology management in organizations worldwide.

Prerequisite: INFSY555 or INFSY570

INFSY 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

INFSY 595: Internship

1-18 Credits/Maximum of 18

Supervised off-campus, nongroup instruction, including field experience, practicums, or internships. Written and oral critique of activity required.

INFSY 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

INFSY 597: Special Topics

1-9 Credits

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

INFSY 860: Data Communications Systems and Networks

3 Credits

The course covers the functional aspects and terminology of computer networks in order for the student to be competent as a manager of a network staff. The course reviews alternative technology solutions and helps implement effective solutions. The course provides an overview of network technology and future developments in the technology. Finally, through this course, students will gain an understanding of network technology and how it integrates with the other IT systems.

Prerequisite: INFSY 540

INFSY 863: Network Security

3 Credits

This is a study of network security concepts, technology, and issues. Authentication, privacy, and integrity of messages are analyzed. INFSY 863 is a follow-up course to INFSY 860, Data Communications and Networking. The objective of the course is that students gain a higher-level understanding of network security. Although the course is designed to appeal primarily to M.S.I.S. students, it is expected that the more technically minded M.B.A. will find the course valuable. Upon successful completion of this course, the student will have an in depth understanding of encryption techniques and the use of keys for encryption. Each student will study the appropriate applications to public keys, secret keys, and session keys. They will gain an understanding of the role of certificate authorities and the public key infrastructure. In addition, students will learn about the various architectures available to transmit information securely across the internet through virtual private networks.

Prerequisite: INFSY 535 and INFSY 860

INFSY 890: Colloquium

1-3 Credits/Maximum of 9

Continuing professionally oriented seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

Instructional Systems (INSYS)

INSYS 581: Theoretical Foundations of Instructional Systems

3 Credits

Analysis of theoretical foundations of the instructional systems (systems and cybernetics, communications, cognitive psychology, sociological, constructivist, ecological) for doctoral students.

Insurance (INS)

INS 575: Risk Management

2 Credits

Develop an understanding of the risks facing corporations and the methods available to deal with those risks.

Prerequisite: B A 531

INS 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

Integrative Biosciences (IBIOS)

IBIOS 541: Critical Analysis of Bioinformatics and Genomics Research Topics

1 Credits/Maximum of 2

A weekly review of current literature related to the area of bioinformatics and genomics research. IBIOS 541 Critical Analysis of Bioinformatics and Genomics Research Topics (1 per semester/maximum of 2) Critical Analysis of Bioinformatics and Genomics Research Topics reviews the recent developments made in the understanding of basic genomics and bioinformatics research. This approach provides an insight into the topics that are shaping the current and future directions in a field that is rapidly evolving and literally transforming lives. Tutorials provide a comprehensive overview of the new and fundamental developments in genomics research and highlight the way in which genomic concepts are applied to basic biological processes. This course will provide insights into computational, evolutionary, and functional aspects of genomic sciences. Basic concepts that describe how life was organized and evolved and applications that promise huge advances in biomedical and biotechnological fields will be discussed. In addition to helping students develop critical oral and written presentation skills, this course is intended to kindle excitement about genomic research among graduate students and provide an intellectual framework for identifying potentially challenging and interesting questions that may be pursued.

IBIOS 551: Genomics

3 Credits

Structure and function of genomes including use of some current web-based tools and resources for studies and research in genomics. IBIOS (BMMB) 551 Genomics (3) IBIOS/BMMB 551 will deal with the structure and function of genomes including the use of some current web-based tools and resources for studies and research in genomics. The overall objective is to learn current information about the structure and function of genomes, to develop facility in the many web-based tools and resources for further studies and research in genomics, and to appreciate the power and limitations of current resources and knowledge. This course is designed as a basic course for any student in the life sciences who needs to exploit the developments and tools in genomics in their own research and who wants to broaden their understanding of the current knowledge and research in the life sciences that are increasingly drawing on genomics advances. The course will be taught by a team of faculty (members active in genomics research and will be video-conferenced. Students' grades will be based on take home exams or assignments that require their understanding of the concepts in genomics and the hands-on use of web-based analysis tools, as well as on class discussion participation. Students will be assigned one or more projects, tutorials, problem sets or essays to complete. Reading assignments will further help students explore the materials, do the assignments and participate in classroom discussions.

Cross-Listed

IBIOS 554: Foundations in Data Driven Life Sciences

3 Credits

Expanded overview of current developments and technique in computational biology and genomics. BMMB (MCIBS) 554 Foundations in Data Driven Life Sciences (3) The successful progression of data-driven biomedical research is obscured by a wide-range of logistical problems related to data handling and processing, a widespread disconnect between developers and consumers of biomedical analysis software, and lack of accessible, well-developed curricula and active learning opportunities necessary for the development of key data analysis skills in the next generation of researchers and clinicians. This course aims at filling these gaps. Topics include fundamental concepts that underpin analysis of sequence data, design of complex experiments, research transparency and reproducibility, as well as result dissemination practices relevant to presentations and publications.

Cross-listed with: BMMB 554, MCIBS 554

IBIOS 572: Benchmark Papers

2 Credits

Discussion of current literature on molecular, cellular and developmental biology. IBIOS 572 Benchmark Papers (2) This is a required course for all CDB graduate students during their second fall semester. It will be team taught using papers selected by the participating faculty members. One to few paper(s) on a specific topic will be assigned each week prior to the meeting between a faculty and the students. The students will read the papers, and then come to the meeting ready for discussion. The faculty member will moderate and guide the discussion, including asking questions, pointing out key aspects that might be missed by students, and giving time to those students who have not had a chance to speak.

IBIOS 593: Molecular biology Laboratory

3 Credits

An intensive laboratory course on the principles and techniques of nucleic acid purification, analysis by restriction enzymes, gel electrophoresis, nucleic acid labeling and hybridization, cloning, sequencing, PCR amplification, and analysis of cloned heterologous gene expression by western blotting.

IBIOS 594: Research Topics

1-15 Credits/Maximum of 15

Supervised student activities on research projects identified on an individual or small-group basis.

IBIOS 595: Internship

1-18 Credits/Maximum of 18

Supervised off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

IBIOS 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Supervised experience in teaching and orientation to other selected aspects of the profession at The Pennsylvania State University.

Intercollege Masters of Business Administration (IMBA)

IMBA 501: Markets, Industry Analysis, and Business Strategy

3 Credits

How markets determine prices and activity in the business firm; the firm's microeconomic and macroeconomic environments; formulation of competitive strategy.

Prerequisite: enrollment in the Intercollege M.B.A. program

IMBA 502: Financial and Accounting Tools

3 Credits

Introduction to financial systems and reports, ability to analyze financial information, apply financial tools, and communicate financial information.

Prerequisite: enrollment in the Intercollege M.B.A. program

IMBA 513: Data Analysis Resource Module

2 Credits

Applications of statistical methods in business management: selection of methods, interpretation of results, and presentation.

Prerequisite: enrollment in the Intercollege M.B.A. program

IMBA 515: Accounting for External Reporting

2 Credits

Ability to read financial reports and analyze their content.

Prerequisite: enrollment in the Intercollege M.B.A. program; IMBA 501 , IMBA 502

IMBA 516: Organizational Behavior and Performance

2 Credits

Analysis of conceptual models, systems, and decision processes consistent with high levels of individual, group, and organizational performance. IMBA 516 Organizational Performance Management (2) The primary objective of this course is to provide an introduction to the research and case study findings relating to the performance of people and groups in organizations. These findings, when taken in the context of contemporary social, ethical, and legal contextual factors, are employed by managers at all levels of high performing organizations to establish, direct, enhance, and deploy desired behavior of individuals, groups, and the organization itself. Course topics will also focus upon mechanisms for continuous system improvement methods such as employee involvement, training, satisfaction, and well-being. Information regarding work system effectiveness, as well as effectiveness of measurement, control, and support systems is also considered.

Prerequisite: enrollment in the Intercollege M.B.A. program

IMBA 517: Corporate Governance

2 Credits

Study of interrelationships among shareholders, boards of directors, and managers (owner agents) and other stakeholders in a modern public corporation. IMBA 517 Corporate Governance (2) The subject matter of corporate governance deals with the nature of the interrelationships among shareholders (owners), boards of directors (representatives of the owners), and managers (agents of the owners). These interrelationships form the basis for the modern corporation. As their agents, managers are supposed to run a company in the interest of its shareholders; the board of directors is expected to monitor the performance of managers and to ensure that they do not stray from their primary obligation to the owners. The subject of corporate governance also encompasses the study of corporations' relationships with its employees, creditors, suppliers, and customers. Finally, as corporations are expected to be good citizens of their communities, corporate governance also extends to the study of corporations; relationships with their communities. Periodic scandals involving major, publicly held companies have underscored the fundamental importance of these relationships. The larger interests of society and of its citizens required that various stakeholders perform their roles in an ethical manner. This course reviews major theories of ethical and moral development, provides cases and exercises to heighten students' awareness of these areas, and reviews heuristics and decisions-models for ethical conduct. This course thus also addresses the emerging area of ethical corporate governance, specifically exploring the how ethical conduct and the ethical underpinnings of corporate governance function to safeguard the interests of all stakeholders.

Prerequisite: enrollment in the Intercollege M.B.A. program

IMBA 521: Strategic Analysis

2 Credits

Analysis of a company case; development of the ability to draw sound conclusions on business strategies and performance.

Prerequisite: IMBA 501 , IMBA 502 , IMBA 513 , IMBA 515 , enrollment in the Intercollege M.B.A. program

IMBA 522: Financial Management

2 Credits

Analyze capital investment projects, examine the general principles of asset valuation, and study the valuation of stocks and bonds.

Prerequisite: IMBA 515 , enrollment in the Intercollege M.B.A. program

IMBA 523: Organizational Development, Intervention and Change

2 Credits

Analysis and assessment of conceptual models, systems, and decision processes for organizational development, intervention and change; transformation and reengineering processes. IMBA 523 Organizational Development, Intervention and Change (2) This course will analyze organizational models using current theory and case study application to discuss the topics surrounding organizational development, intervention and change. The course focuses on the human and social aspects of the organization as a way to improve the "fit" between individuals and the organization and between the organization and the environment. This analysis and assessment helps to improve the organization's overall performance and stakeholder satisfaction. The course emphasizes the use of Organization Development (OD) as one of the most effective approaches to introduce changes to organizations and to facilitate intervention. The course elaborates on knowledge and techniques from the behavioral sciences to create a learning environment through increased trust, open confrontation of problems, employee empowerment and participation, knowledge and information sharing, the design of meaningful work, cooperation and collaboration between groups and the full use of human potential.

Prerequisite: enrollment in the Intercollege M.B.A. program and IMBA 516

IMBA 530: Marketing in a Global Environment

3 Credits

Global marketing planning and strategic formulation for profit and non-profit firms in creation, promotion, pricing, and distribution of goods and services.

Prerequisite: IMBA 501 , IMBA 513 , enrollment in the Intercollege M.B.A. program

IMBA 531: Project Management

2 Credits

A problem-based, interdisciplinary course in project management skills and techniques needed to manage projects in a modern business environment. IMBA 531 Project Management (2) Project management has been labeled by Fortune Magazine as the number one career choice for the coming decade. Increasingly, organizations are adopting project management techniques and structures within their business framework. Project management offers the twin advantages of allowing organizations to create products and processes efficiently, through optimal use of resources, and rapidly, to respond to rapid time-to-market demands. This course would give business majors a competitive advantage in the job market, as companies are in great need of a trained cadre of qualified project managers who can allow the business firm to operate to its highest potential. The role of the instructor in this course

is to train students in the wide variety of demands and skills for which they must be qualified: the ability to exert leadership in managing project teams, an understanding of people and behavioral skills, and the ability to effectively use computer-based scheduling and tracking software to keep to timetables and schedules. The course will involve semester-long projects, either developed by the instructor or developed (in collaboration with the instructor) by students involved in business enterprises. As a result, students would have real-time experience in the challenges of creating a unified team, solving problems, tracking their projects, and presenting a final paper and presentation on the process.

Prerequisite: enrollment in the Intercollege M.B.A. program

IMBA 543: Accounting for Internal Decision Making

2 Credits

Covers basic concepts, issues, tools, and techniques in the use of accounting information for internal decision making.

Prerequisite: IMBA 502 , enrollment in the Intercollege M.B.A. program

IMBA 544: Managing Human Resources

3 Credits

Processes and issues related to staffing and retaining human resources.

Prerequisite: IMBA 501 , IMBA 513 , enrollment in the Intercollege M.B.A. program

IMBA 550: Corporate Information Strategy

3 Credits

Information technology supporting management decision making, operations, and creation of new products and services; electronic commerce in global markets.

Prerequisite: enrollment in the Intercollege M.B.A. program

IMBA 560: Corporate Innovative Strategies

3 Credits

Formulation and implementation of a corporate innovation or technology strategy.

Prerequisite: enrollment in the Intercollege M.B.A. program

IMBA 561: Global Operations and Supply Chain Management

3 Credits

Effective management of the flow of goods and services.

Prerequisite: IMBA 513 , enrollment in the Intercollege M.B.A. program; also previous course sequencing in the IMBA program is required for this course

IMBA 562: Global Business Management

3 Credits

Establishing and expanding businesses in global markets and managing multinational firm strategies and operations. IMBA 562 Global Business Management (3) This course examines the unique opportunities and problems that confront multinational companies and international

managers as they navigate the company through the extreme complex and ever-changing global economic, political-legal, socio-cultural, and technological environments. It studies the decision choices of international managers regarding business strategies for production and marketing of product and services, the modes of entry into foreign markets, the management of such functions as physical and human resources, production of goods and services, financial management, controlling of operations, labor relations, and conducting businesses ethically. It is designed to help students to gain insights into the complexities of managing across borders and cultures.

Prerequisite: enrollment in the Intercollege M.B.A. program

IMBA 573: Strategic Planning

3 Credits

Application of knowledge in creating and sustaining competitive advantage; development of skills necessary for writing a strategic plan.

Prerequisite: enrollment in the Intercollege M.B.A. program; completion of all courses prior to final term

IMBA 574: Strategic Financial Decisions

3 Credits

Advanced capital project analysis; evaluating levered investments; application of option valuation principles to strategic decisions.

Prerequisite: enrollment in the Intercollege M.B.A. program; IMBA 502 and IMBA 522

International Affairs (INTAF)

INTAF 500: Research Design

3 Credits

This course provides a general overview of empirical research methods appropriate for international affairs specialists. The approach is hands-on, with a focus on learning practical skills for evaluating real-world events.

INTAF 501: Water and Sustainable Development

3 Credits

This course addresses the scientific theory and practical considerations necessary to manage water resources in an international sustainable development context.

INTAF 502: Science, Technology, and International Policy

3 Credits

Examines science and policy communities, importance of science and technology to international affairs, scientific issues likely to affect international policy.

INTAF 503: Hazards, Disasters, and International Affairs

3 Credits

Hotspots, tipping points, and international approaches to prepare for, respond to, and recover from hazards, disasters and complex humanitarian emergencies.

INTAF 504: Political Economy of Development and Growth

3 Credits

Theories of economic growth and established empirical evidence are used to explain differential levels of economic development across the world. INTAF 504 Political Economy of Development and Growth (3) This course examines the reasons why different nations realize diverse long-run levels of welfare. Possible determinants of the differential outcomes include different rates of accumulation in physical capital, rates of technological innovation, the impact of human and financial capital, and the impact of demographic changes with increasing levels of economic development. Further extensions include a consideration of the impact of the openness of economies, geographical location, and exposure to disease vectors. In addition, the course considers the impact of institutions, including domestic institutions, international institutions, as well as multilateral forms of cooperation between economies. Types of institutions to be considered will include micro-level institutions (those that function most obviously at the individual agent level), as well as institutions that govern societies at more aggregate levels. The course also examines evidence on whether there are interaction effects between the determinants of growth (for instance, whether the impact of openness is different under democratic or autocratic political governance). The course will consider relevant theory, but will place an emphasis on examining available data sources in order to test alternative explanations. Given the International Affairs context, particularly strong emphasis is placed on drawing from literatures that reflect the strong interdisciplinary nature of International Affairs programs. This includes perspectives from economics, law, political science and sociology.

INTAF 505: Strategy, Conflict, Peace

3 Credits

The course teaches the principal solution concepts to the analysis of strategic interaction in static and dynamic contexts, and under incomplete information. INTAF 505 Strategy, Conflict, Peace (3) The purpose of this course is to provide the analytical tools required to deal with international affairs situations that involve strategic actions - that is, actions whose outcome depends on the interaction with other decision makers. While the approach of the course is applied, with recourse to many illustrations by real examples, the primary concern of the course is with the development of the appropriate analytical tool kit to be able to deal with choice in the presence of strategic interaction with other agents. The core tool kit is provided by game theory, and this is the focus of the course. Coverage will be of the representation of games, solution concepts in static as well as dynamic games, and the role of information in games. While primary attention will be on non-cooperative strategic interaction, some results from cooperative game theory are also considered. Presentation of core analytical techniques will be in the form of lectures. Many applications will be presented by course participants. Applications are drawn from concrete examples encountered in the literature. Strong emphasis is placed on applications that are encountered by agents in international contexts. Since such international agents span the range from nations, political parties, firms, multinationals, households and firms, applications are

multidisciplinary. Applications are drawn from (but not limited to): voting and agendas; reciprocity; surprise attack and disarmament; nuclear deterrence; randomization of promises and threats; sequential bargaining; time consistency; reputation; location games; partnership games; tariffs; Median Voter Theorem; political participation; contracts; guarantees; reputation and incomplete information; signaling; cheap talk; tournaments; coalition formation and the importance of stable preference-driven cooperation in an anarchic world.

INTAF 506: International Economics: Principles, Policies, and Practices

3 Credits

This course addresses the principles, policies, and practices in international trade and finance that are fundamental for understanding international economic relations and the future of the global economy. The course examines the economic principles underlying behaviors and policies in international and domestic public affairs and explains how to evaluate and conduct economic analyses.

INTAF 508: Domestic Influences on Foreign Policy

3 Credits

This course will examine how domestic politics influences the formulation and implementation of foreign policy in the United States and other major powers. INTAF 508 Domestic Influences on Foreign Policy (3) This course will examine how domestic politics influences the formulation and implementation of foreign policy in the United States and other countries. Among the factors considered will be the role of lobbyists, special interests and bureaucratic politics. Among the major topics covered will be national identity, the politics of national security since World War II, foreign policy formulation in China, the domestic sources of American foreign policy, case studies in buying influence, the influence of think tanks, public opinion and ethnic groups, how other countries attempt to influence American foreign policy and how domestic groups in other countries try to influence their own foreign policy. This course will be extremely useful to any student wishing to understand how governments formulate and implement foreign policy and how that has been affected by domestic politics in the past and today. Students will learn about the history of political influences on foreign policy and how that had changed over time, especially since the end of the Cold War. Students will also develop their ability to think critically and to apply that thinking to historical and present-day examples of interest groups influencing foreign policy. The course will also emphasize professional skills including the development of the student's ability to write and to make in-class presentations.

INTAF 510: Cross Cultural Conflict Resolution

3 Credits

Across the globe there are more laws and provisions in place to protect human beings from discrimination than at any other time in history and yet there are more incidents of conflict, intolerance, bias, and violence than ever. How are we to make sense of these two competing realities? How can we become ethical leaders in the face of such contrasts and complications? This course combines perspectives from communications, psychology, sociology, political science, law and legal studies, human rights, identity-based studies, media studies, and cultural studies to engage questions of how cultural difference and discrimination play a role in conflict and resolution. Topics to be covered are 1) how societies create inegalitarian categories of identity, 2) how those divisions create conflict, and 3) how those divisions

hinder conflict resolution. The course will look at a variety of ways that societies come to categorize forms of human life according to religion, nationalism, patriarchy, ethnic identity, and other forms of social division and stereotyping. One key area we will address is the development of law and other instruments that both protect and disenfranchise vulnerable populations. We will also look at strategies for cross-cultural community development and peace building. The topics will be studied in a cross-cultural context allowing students to consider these issues from a range of global perspectives.

INTAF 511: Ethical Dimensions in Food and Agricultural Governance

3 Credits

Famines around the world have long made news headlines, and in recent years the news includes a discussion of the so-called "diseases of affluence" that come about, in part, due to an overabundance of food (i.e., Type II diabetes, heart disease). While, the natural environment affects regions of food security and insecurity, the policy environment plays an equally strong role in constructing our global food systems. For example, how have changing agricultural policies shaped our food safety problems, such as E. coli contaminated meat or spinach? How have government policies related to labeling of organics shaped the growth of consumer demand for organic agriculture and food products? This class analyzes the socio-economic, political, and cultural construction of our food systems and the ways in which institutions and individuals involved with these systems have experienced dramatic changes in the twentieth and twenty-first centuries. We also explore and evaluate the ethical dimensions of agriculture and food policy at the global, regional, and national levels and the ways these policies impact the flow of food around the world (e.g., the World Trade Organization, transnational corporations, NAFTA, the European Union, and national governments). By the end of this course, students will be able to describe the institutions and organizations that are involved in the provision of food at national and international levels, identify problems with the dominant agriculture and food system, and evaluate the strengths and weaknesses of many of the proposed solutions for creating a more sustainable and equitable food system.

INTAF 512: Institutional Change and Development

3 Credits

Over the past two decades, the phrase "Institutions matter" has become a leitmotif in economics and policy circles. This course is an overview of the research (both theoretical and empirical) on institutions as the fundamental driver for economic development, with a particular emphasis on institutional change and institutional/policy reforms. The purpose of the course is to develop an understanding of the institutional foundations of an economy while critically assessing the conventional discourse in the discipline. Throughout the course, we approach institutional change from a historical perspective. Our focus is on institutional challenges faced by developing nations. In light of the recent institutional turmoil in Western countries, we also discuss institutional erosion and the rise of populism in developed nations.

INTAF 513: Applied Time Series Analysis for Social Science Contexts

3 Credits

This course is designed to introduce the modeling challenges presented by time series data, and panel data with a large time dimension. Emphasis is placed on developing an understanding of the distinction between stationary and nonstationary (constant mean, variance vs.

nonconstant mean and variance data) for estimation purposes in time series contexts. Since nonstationarity is very prevalent in social science applications, understanding estimation approaches to nonstationary data is crucial for nonspurious estimation results. The course will place considerable emphasis on the development of maximum likelihood vector error correction mechanism estimation as a solution to nonstationarity. Throughout, problem sets and exercises place emphasis on real world applications and estimation challenges.

Prerequisite: INTAF 803

INTAF 514: International Development and The Ethics of Development Assistance

3 Credits

This course will provide an overview of the study of international development as a field and as an idea. International development has changed considerably post WWII, not only with some of the same organizations still participating in international development, but also with many new actors and organizations. Alongside organizations and actors have been many academic fields that study and influence aspects of international development, including: anthropology, economics, history, political science, sociology, demography, and public health. We will explore major approaches to international development historically and in the present, as well as consider the effectiveness of international development and the ethics of development assistance. The primary goals of this course are for you to: cultivate a base of knowledge about international development, gain familiarity with topics that people in a variety of disciplines study and shape as it relates to international development, and develop an informed and critical perspective as it relates to the practice and ethics of international development.

INTAF 534: Political Economy of Energy and Extractive Industries in Africa (Oil and Mining)

3 Credits

Given the rising global demand for energy and resources, Africa's production of oil and solid minerals has already produced very significant positive as well as negative impacts on the continent's political, economic, and social conditions. This seminar examines the extractive industry-driven changes in Africa's political economy, as well as in the continent's foreign relations. Students will examine the institutional basis under which the expansion of the industry is taking place in Africa. This will involve discussions of the institutional characteristics of Africa, including issues of land tenure and property rights laws, how institutional systems are changing in order to facilitate the industry's expansion, and the repercussions of these changes upon society. The course also interrogates the relevance of international efforts to mitigate some of the adverse impacts of the industry. Among such efforts is the UN Guiding Principles for Business and Human Rights. Overall this seminar examines the industry's impact on Africa's socioeconomic development and global relations, and concludes with how African countries might deal with the adverse impact of the Oil and Mining industry.

Cross-listed with: AFR 534, PLSC 534

INTAF 567: Terrorism

3 Credits

This seminar provides a general and cumulative investigation into the phenomenon of terrorism from a Political Science perspective. It is a study of terrorism with an attention to what it is 'theoretically,

conceptually, empirically' and how and why it is used by nonstate actors; its political, economic, and social root causes; its consequences to political, economic, and social institutions and outcomes; and the implications of current research on terrorism and counterterrorism. Although the study of terrorism has a long pedigree in the social sciences, research by political scientists became more extensive following the September 11, 2001 attacks on the World Trade Center. This course critically evaluates this new literature, noting its contributions, limitations, gaps, and opportunities for future discovery. Much of the contemporary scholarly literature on terrorism makes use of state-of-the-art political science research methods and quantitative analysis.

Cross-listed with: PLSC 567

INTAF 568: Psychology of Terrorism

3 Credits

This course examines the causes and consequences of terrorism, and the responses to terrorism from a psychological perspective, to include Christian extremism, Islamic Fundamentalism, Jihadism, Left wing extremism and Marxist terrorism, Right wing extremism, and single-issue terrorism. It draws on research from a variety of disciplines in order to examine terrorist ideologies; the motives, strategies, and behaviors of terrorists and terrorist leaders; how people come to join terrorist groups; methods of recruitment; terrorist tactics; the psychological consequences of terrorism on individuals, communities, and global societies; psychological counterterrorism; reactions to counterterrorism efforts; terrorism prevention; and possibilities for disengagement and deradicalization.

Cross-listed with: PLSC 568, PSY 568

INTAF 590: Colloquium

3 Credits

Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

INTAF 594: Research Topics

1-15 Credits/Maximum of 15

Supervised student activities on research projects identified on an individual or small-group basis.

INTAF 595: Internship

1-12 Credits/Maximum of 12

Supervised off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

INTAF 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and that fall outside the scope of formal courses.

INTAF 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

INTAF 597B: **SPECIAL TOPICS**

3 Credits

INTAF 598: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

INTAF 599: Foreign Studies

1-12 Credits/Maximum of 24

Courses with a research orientation offered in foreign countries by individual or group instruction.

INTAF 603: Foreign Academic Experience

1-12 Credits/Maximum of 12

Foreign study and/or research approved by the graduate program for students enrolled in a foreign university constituting progress toward the degree.

INTAF 801: Actors, Institutions, and Legal Frameworks in International Affairs

3 Credits

Addresses the principal actors, institutions, and legal frameworks which operate in international relations.

INTAF 802: Foundations of Diplomacy and International Relations Theory

3 Credits

Addresses the central tenets of diplomacy and international relations and theories and concepts that underpin the study of international relations.

INTAF 803: Multi-sector and Quantitative Analysis

3 Credits

Introduces students to quantitative methods applicable to various issue areas, including international relations, economics, business, law, education, health, and environment.

INTAF 804: Global Cultures and Leadership

3 Credits

Introduces students to cultural theories and to an understanding of how socio-cultural beliefs may impede or accelerate social change.

INTAF 810: Energy, International Security, and the Global Economy

3 Credits

This course explores the economic, political, and strategic implications of ongoing trends in global energy markets, particularly oil and gas markets.

INTAF 810 Energy, International Security, and The Global Economy (3)

This course explores the economic, political, and strategic implications of ongoing trends and structural shifts in global energy markets. It focuses especially on international markets for crude oil and natural gas; attention is also devoted to nuclear energy, the international nuclear industry, and nonproliferation challenges. Students will develop a deep appreciation of the role of energy, and especially hydrocarbon-based energy, in contemporary international affairs. They will learn about the historical development and evolution of hydrocarbon-based energy and the international oil and gas industry; about the various types of contractual arrangements for cross-border investment in upstream oil and gas development and what the differences among these types of agreements reflect regarding the shifting balance of power between resource-owning national governments and foreign investors; and about why and how major energy market players shape their interactions on the basis of political and strategic calculations, along with commercial and economic considerations. They will also learn about the economic and political factors affecting the contribution of nuclear energy to the global energy balance; about the major proliferation risks associated with civil nuclear technology; and about the international regime that has been developed to mitigate these risks and the most pressing challenges to this regime.

INTAF 811: Estimative Analysis in International Strategy

3 Credits

Analytical methods to estimate future conditions as they might influence international policy, negotiations, or strategic planning.

INTAF 812: The Role of Intelligence in International Relations

3 Credits

This course examines how governments gather intelligence, how it is analyzed and what impact it has on policy makers.

INTAF 814: U.S. Policy in the Middle East

3 Credits

This course focuses on the strategic challenges facing U.S. policymakers in one of the world's economically, politically, and strategically most important regions. INTAF 814 U.S. Policy in the Middle East (3) This course explores the strategic challenges facing U.S. policymakers in the Middle East, one of the world's economically, politically, and strategically most important regions. It draws on readings and class discussion to help students develop both a sense of the historical evolution of U.S. policy toward the Middle East and an analytic framework for understanding current policy debates. Students will develop a deep appreciation of the impact of U.S. engagement in the Middle East on modern international history and contemporary international affairs. They will learn about the Middle East's place in the United States post-World War II and post-Cold War grand strategy, about America's decades-long quest for strategic primacy in the region, and about competing visions among American elites for the exercise of that primacy. They will examine the key bilateral relationships (with Saudi Arabia, Israel, and -since 1979 - Egypt) that have shaped U.S. foreign policy toward the Middle East. They will also explore America's long struggle with Saddam Hussein's Iraq and evaluate the U.S. project to build a post-Saddam Iraq that would help consolidate America's post-Cold War dominance in the region. Against this backdrop, students will also learn about major indigenous challenges to American hegemony in the Middle East - e.g., the Islamic Republic of Iran, Islamist resistance movements, and rising demand for

participatory Islamist governance among regional publics - and assess U.S. approaches to dealing with these challenges. Students will consider alternative perspectives on jihadi extremism and whether America's self-declared "war on terror" has been self-defeating. Likewise, they will examine America's response to the Arab Awakening, with a particular focus on U.S. military interventions in Libya and (indirectly) in Syria, and Turkey's evolving role in the region. Finally, they will look at Russia's resurgence in Middle East affairs and at the impact of China's deepening engagement in the Middle East and the prospects for Sino-American competition for influence there.

INTAF 815: Dynamics of International Economic Order: Law, Politics, and Power

3 Credits

This course examines the cross-cutting relationship between political power and global economic governance. INTAF 815 Dynamics of International Economic Order: Law, Politics, and Power (3) This course explores the cross-cutting relationship between political power and global economic governance. It considers how nation-states define international economic order through the creation of legal frameworks and rules-based regimes; how shifts in the international distribution of power impact these frameworks and regimes; and how, in contemporary context, the United States and China approach global economic governance as part of their grand strategies. To ground their engagement, students will appraise philosophical and analytical perspectives on international economic exchange and economic order - mercantilism, liberalism, realism, and institutionalism. They will examine the concept of hegemonic hegemony and debates over whether economic openness requires a hegemon. Against this backdrop, students will investigate the relationship between American primacy and international economic order. They will consider how U.S. primacy and America's strategic aspirations coming out of World War II shaped the postwar economic order with regard to multilateral trade liberalization (the General Agreement on Trade and Tariffs) and monetary relations (the Bretton Woods gold exchange standard). They will evaluate challenges to America's vision of postwar economic order posed by Asian developmentalism and "mercantile realism." Likewise, they will assess the OPEC revolution, the American/Western response thereto, and the impact of these developments on the international economic order. Students will continue examining the relationship between American primacy and international economic order by reviewing interpretations of economic globalization as a recasting of the original, post-World War II pax Americana. They will look at how reconstituting American primacy through globalization affected multilateral trade liberalization (the World Trade Organization), monetary relations (the post-Bretton Woods dollar standard), and financial liberalization. They will also evaluate competing visions of post-9/11 American primacy - liberalism, neoconservatism, and realism. Students will then turn to the impact of China's rise on international economic order. They will assay the historical backdrop of China's rise, ongoing processes of economic reform and modernization, Chinese grand strategy, and the challenges China's rise poses to international frameworks for trade and investment, finance and monetary relations, and energy. They will also consider the implications of China's rise for Asian regionalism, the BRICS (Brazil, Russia, India, China, South Africa), and the "global South." Finally, through case studies on nuclear energy and nonproliferation and on Iran sanctions, students will look at how contestation between alternative views of international order affects global governance in specific arenas. They will also reflect on the ramifications of these cases for the future of international economic order.

INTAF 816: War and Peace

3 Credits

This course examines how wars begin, how they end and the responsibility of the international community in bringing an end to the fighting and dealing with the effects of the conflict. INTAF 816 War and Peace (3) The course will examine the types and causes of war and how they are brought to an end. It will consider the role of the international community and international organizations in mediating the conflict and helping to bring about peace both through formal negotiations by governments (track I diplomacy) and through the efforts of third parties and nongovernmental entities (track II diplomacy.) It will also address the evolving role of the international community, the concept of responsibility to protect, and how and when outside interventions are undertaken. It will look at war and the origins of humanitarian intervention, conflict analysis, methods and techniques of peacemaking in international conflict including mediation, the role of the UN in conflict peacekeeping and peace-building, and democracy and the economics of war.

INTAF 817: Weapons of Mass Destruction and International Security

3 Credits

Although no nuclear weapon has been used in war in 73 years, they are used every day to affect international security decisions. This course will explore how nuclear weapons revolutionized thinking about war and peace among major powers and how they can become a primary focus of international diplomacy. It will examine why WMD programs (perhaps incorrectly) have come to be seen as a potential cause of war in some contexts and as a primary deterrent to war in others. The course will provide students with the technical understanding of the major classes of WMD (nuclear, chemical and biological weapons) and their effects and it will examine the evolution of international security thinking about their role. It will look both at how major powers (the U.S., Russia and China) conceive of the role of WMD and also how other countries and sub-national groups might consider them. The course will look at how nuclear and biological weapons in particular are for the first time in a generation becoming of increasing concern to strategic thinkers. Finally it will look at the means the U.S., other major powers and the broader international community have developed to limit and perhaps someday to eliminate the threat WMD pose to international peace and perhaps to human existence.

INTAF 818: U.S. National Security

3 Credits

This course examines: 1) how states fight wars and use force; 2) how the characteristics of nuclear and conventional weapons affect strategic thinking; 3) the manner in which the states match interests with capability and domestic politics, 4) civil military relations and 5) how wartime assessment influences policy, and 6) how to present and write professional briefings. The course will focus on both the general pattern among all states and the application of these concepts to U.S. national security. Students will be expected to develop the knowledge and skills to think, speak, and write knowledgeably about the dynamics of U.S. national security specifically and international security more generally.

INTAF 819: Grand Strategies of Established and Rising Powers

3 Credits

This course is about the grand strategies of the world's major powers-states that independently exercise significant influence over their external

environments in ways that help shape the overall character of global politics; depending on its foreign policy orientation, such a state may also be described as either an established or rising power. The course develops a framework for understanding and explaining a nation's foreign policy and applies it to analyzing the grand strategies of the most important established and rising powers in contemporary world politics.

INTAF 820: Economic Development and the Environment

3 Credits

This course provides an overview of the economics of environmental policy by focusing on the issue of environmental/resource management and sustainable development. It discusses the role of government interventions in addressing environmental problems, such as pollution, climate change, resource management, etc. The course seeks to convey some of the basic concepts of environmental and resource economics and initiate discussions about environmental policy through real-world examples.

INTAF 821: Property, Poverty, and Development

3 Credits

This seminar is for those who are interested in property ownership and the role that it plays in economic development. Case studies will be taken from across the developing world, with a particular focus on Latin America and the Caribbean. Since the time of the philosopher and social reformer, Jeremy Bentham, we have understood that the poor, like others, are more likely to invest in property if they own it. Hernando De Soto has famously argued that non-transparent legal systems, and titling systems in particular, pose severe impediments to the participation of the poor in capitalist economies. Without title, the poor are less likely to invest in their properties and are often unable to access credit. De Soto estimates that for the developing world, the total value of real estate held by the poor (but not formally titled) is more than 20 times foreign direct investment and more than 90 times all foreign aid for the last 3 decades. The extent of De Soto's influence can hardly be overstated. In the policy world, his work has inspired decades of World Bank-funded titling programs across several continents. In the academic world, his work has inspired soul-searching among economists and development scholars across the methodological spectrum. Some have argued for communal systems of collective land tenure. Others dispute his estimates of property currently owned by the poor and argue that granting legal title has not improved credit access. Some have also argued that titling systems simply replicate current inequalities. Moreover, in societies where women work the land but do not have equal status in society or in law, their land claims are unlikely to be recognized. Yet others have criticized De Soto's emphasis on titling arguing that land titling by itself is unlikely to make a significant impact on poverty reduction without parallel reforms such as improving access to the formal banking system, financial literacy and streamlining business regulations. Finally, others question whether extensive investments in titling systems represent a prudent investment in the conditions of extreme economic scarcity that characterize many developing countries, suggesting that in such circumstances, a more "modest" approach to legal reforms may be more prudent. In summary, this seminar will focus on De Soto's ideas on the importance of property reform in combatting poverty and the critiques, particularly in the context of Latin America and the Caribbean.

INTAF 822: Global Media and Political Journalism

3 Credits

This course traces the history of political reporting in a global context, addresses challenges brought on by the rise of social media and fake news, covers issues of propaganda and censorship, and offers students an opportunity to hone their own skills as political reporters. The course helps students develop a thorough understanding of the way politics and government are reported in the media as well as gain the confidence to make reasoned judgments about the truth and relevance of media coverage, particularly in an international context. Students will develop an appetite for monitoring, analyzing and reacting to current changes in the relations between politicians and political journalists. Students will develop critical thinking skills about political issues and dynamics, strong instincts for finding good political stories, and sharp writing skills with an attention to detail and nuance in reporting.

INTAF 853: Engineering, Law, and Policy Systems

3 Credits

This course provides a broad exploration of the relationship between engineering, policy, and law. From driverless cars to AI-powered systems, engineering is transforming public and private spaces. As these new technologies leave the lab and operate in new spaces, each new technology represents a system within that larger, higher-order system. The transformation of these spaces and the interaction of these once-separate systems will be shaped by, and in turn will shape, the public policies of local, state, national, and global policymaking systems. This interdisciplinary course has two objectives. First, it considers the classic engineering problem of integrating subsystems into a larger, higher-order system. In this class, the larger system includes not only other physical systems in the operating space, but also social, legal, and political systems. Second, it considers traditional legal and policymaking institutions as constrained optimization problems. This course identifies the legal and political constraints engineering solutions must satisfy in order to come online.

Cross-listed with: LPE 853

INTAF 890: Colloquium

3 Credits/Maximum of 999

Continuing seminars that consist of series of individual lectures by faculty, students, or outside speakers.

INTAF 897: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject with a professional orientation that may be offered infrequently; several different topics may be taught in one year or semester.

INTAF 899: Foreign Studies

1-12 Credits/Maximum of 24

Courses with a professional orientation offered in foreign countries by individual or group instruction.

International Agricultural Development (INTAD)

INTAD 577: Global Agricultural Systems

3 Credits

Global food demand is expected to double over the next few decades and agriculture is arguably the world's major driver of global environmental change. Therefore the challenge is increasing agricultural production and yields without comprising biophysical processes and environmental sustainability. This course tackles this issue through a review and survey of world farming and agricultural production systems from a biophysical, technical and agro-ecological perspective. Students will learn about basic environmental factors, constraints, threats, and solutions to these systems. Emerging topics and key innovations such as sustainable intensification, GMOs, precision farming, global climate change, and biodiversity are discussed in the context of complex socio-technical and agro-ecological systems. The focus is on developing countries but includes different agro-ecological zones, from cold temperate regions to the sub-tropics, and from the arid tropics to the sub-humid and humid tropics.

INTAD 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

INTAD 820: International Agricultural Development Seminar

3-6 Credits/Maximum of 6

Students will examine international agricultural development issues through observation of systems, methods, and policies.

International Business (IB)

IB 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

IB 800: International Business Management

3 Credits

This is a foundational course in international business. The basic content of the course includes: 1) an overview of the means of conducting international business, with an emphasis on what makes international different from domestic; 2) the effects of the social systems within countries on the conduct of international business; 3) the major theories explaining international business transactions and the institutions influencing those activities; 4) the financial exchange systems and institutions that measure and facilitate international transactions; 5) the dynamic interface between countries and companies attempting to conduct foreign business activities; 6) corporate strategy alternatives for global operations; 7) international activities that fall largely within functional disciplines

Prerequisite: MGMT 501 ACCTG 511; ACCTG 512

Italian (IT)

IT 596: Individual Studies

1-9 Credits/Maximum of 9

CREATIVE PROJECTS, INCLUDING NONTHESIS RESEARCH, WHICH ARE SUPERVISED ON AN INDIVIDUAL BASIS AND WHICH FALL OUTSIDE THE SCOPE OF FORMAL COURSES.

IT 801: Fundamentals of Reading Italian for Research

3 Credits

This course provides the fundamental skills for reading Italian prose to graduate students with special interests in conducting research using Italian materials.

Japanese (JAPNS)

JAPNS 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

Jewish Studies (JST)

JST 524: Remapping the Holocaust

3 Credits

In most university courses, the Holocaust is taught chronologically, beginning with the rise of the Nazi Party and then following the German armies through Europe and into the Soviet Union. The retreat of those same forces beginning in 1943 parallels the concentration and professionalization of the killing process which then begins to break down as the war comes to an end. This narrative is not incorrect, and certainly makes sense for introductory courses. Yet it also mirrors the perpetrators' perspective. A graduate course allows us to explore different perspectives on the war and genocide and how these affect both the periodization and the geography of the Holocaust. In this course we will examine a number of divergent historiographic trends regarding the origins, enactment, end, and aftermath of the Holocaust. These will help students to think more broadly about the place of the Holocaust in world history and how new theories, methods and questions can be applied to other historical events.

Cross-listed with: GER 524

JST 530: Ancient Judaism: Special Topics

3 Credits/Maximum of 3

This course offers rotating topics in the study of ancient Judaism. The choice of primary topic in each iteration of the course is made by the instructor. The course features advanced study of Judaism in a range of historical settings, from its beginnings in biblical Israel to the development of Jewish texts, traditions, and communities in the Hellenistic and Roman periods. By adopting a critical approach, this course offers students an opportunity to conduct and examine research on ancient Judaism in a theoretically informed, cross-disciplinary manner. The course brings methods, material, and insights from Jewish studies to bear on ongoing work in many fields, including history, philosophy,

political theory, religious studies, and comparative literature. Course topics may be thematic, revolving around specific themes like diaspora, Jewish identity, Jewish experiences of empire, or questions of gender. They may be organized around specific places or periods, for example: the history of Jerusalem, Jews in Hellenistic Egypt, first-century Palestine, Roman-era Alexandria, or late antique Babylon. They may also include the analysis of Jewish literature or textual traditions within their social, political, religious, and cultural contexts. The aim of the course is to provide students with critical exposure to aspects of ancient Judaism as well as a solid grounding in scholarly research methods.

Cross-listed with: CAMS 530, RLST 530

JST 532: Holocaust and Visual Culture

3 Credits

This course studies how art, literature, film, and other media can provide a perspective on one of the most horrific events in human history, the Holocaust: the genocidal murder of more than six million men, women, and children (mostly Jewish) under the Nazi regime during World War II. The course examines the theoretical questions involved in any attempt to capture what appears to be beyond comprehension in terms of moral outrage and the sheer scale, inhumanity, and bureaucratic efficiency of the violence perpetrated by the Nazis. This course examines formal approaches of depicting the Holocaust in literature and film, as well as photography, museum installations, and memorials. Topics to be discussed include include memorialization (Holocaust museums and memorials), mass murder of the disabled, national guilt, survivor's guilt, stigmatization, and the ethics of historical representation. The course will analyze cinematic strategies for representing the unrepresentable, dark humor about the Holocaust, the persistence of the past, Nazi propaganda, Holocaust photography, trauma theories, graphic novels, the Nuremberg trials, survivor memoirs, representations of the Nuremberg Code and the International Bill of Norms, and possibilities for art after Auschwitz.

Cross-listed with: GER 532, VSTUD 532

JST 535: Studies in Jewish American Literature

3 Credits

This course offers students a working analytical familiarity with the history of Jewish writing in the United States (in North American context) and with both the history and the current state of professional study of it. Attention will be paid both to dominant and alternative narratives of this literature. Major historical topics include the earliest, pre-19th century Jewish writers in America; 19th century Jewish American writers; writers of the great Ashkenazi immigration wave of 1881-1924; interwar proletarian and modernist writers; postwar writers of assimilation; the mainstreaming of Jewish American literature in the 1950s and 1960s; post-"breakthrough" Jewish American writers; and 21st-century Jewish American literature and the new immigration. The course analyzes the development of the professional field of Jewish American literary study, including its prehistory and origins in Wissenschaft-based historicism; the professionalization of the field in the Viet Nam era; the growing dominance of so-called New Jewish Cultural Studies of the '80s and '90s; and new theoretical approaches of the first decades of the 21st century. Finally, the course examines the key debates and faultlines in the field today, including the divide between historicist and critical approaches; differences between English Department-based and Jewish Studies-based Jewish American literary study; the situation of Jewish American literary study vis-à-vis Americanist literary study and English Department-based literary study more generally; Cultural Studies-

based approaches to the field vs. Literary Studies-based approaches; Comparativist approaches vs. non-Comparativist approaches; the move toward interdisciplinarity; and the ongoing struggle to theorize the field.

Cross-listed with: ENGL 535

JST 536: Global Cultures of Genocide

3 Credits

The history and memory of the Holocaust, the Armenian, Cambodian and other forms of genocide, are often taught separately in different disciplines. This course will examine them together through the various ways different societies dealt with, experienced, and understood these. Using the extensive literature on the history of genocide this course further suggests ways in which these tragic events affected and were entangled by each other's. Specific content will vary according to individual instructor, but topics may include victim cultures, ethnic cleansing, trauma, human rights, dark tourism, memorials, and architecture, as well as the general impact of these tragedies on global politics, or the way the memories of the tragedies were entangled with the civil rights and other struggles in American and global history.

JST 537: Photography, Race, Genocide

3 Credits

This course explores the role of photography in the context of the racialized politics of genocides and their aftermaths. The course aims to critically examine photographic evidence of genocidal violence, revealing the long shadow of modern genocides from colonialism, to the Holocaust, the Armenian, Cambodian, Rwandan genocides, to the present. At the intersection of modern constructs of race as they culminate in genocidal violence, the course investigates the political and ethical potential of photography. Topics include: definitions of genocide; modern genocides; colonialism and the concept of race; the origins of photography; photography in literature and film; the civil contract of photography; the ethics of testimonies; atomic light; commemoration and the aftermath of genocides; race after technology.

Cross-listed with: GER 537, VSTUD 537

JST 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

Kinesiology (KINES)

KINES 500: Theory and Application of Evidence-Based Practice

3 Credits

This course provides a foundational overview of evidence-based practice (EBP) in the health sciences, which includes an overview of the seven steps of the EBP process. Conceptual models that demystify the process of translating research into clinical practice will be presented; furthermore, common misconceptions of EBP will be explored. Students will be exposed to organizational cultures that foster a spirit of inquiry, and contemporary attitudes to identifying sources of evidence to be considered in answering a focused clinical (or researchable) question. An emphasis will be placed on developing core competencies in the gathering, and scrutiny of information to draw conclusions that are

based on robust, inclusive, and meaningful evidence. Additional focus will consist of cultivating skill with implementing EBP in a manner that best fits the context of care/intervention, aligns with targeted goals, addresses priority problems as well as guides a systematic, and evaluative approach to collaborative practice change. Determinants of an EBP environment, and factors that lend to its sustainability or demise will also be discussed. Leveraging population health initiatives as a mechanism to move from silos to synergy will be highlighted given evidence to suggest an interdisciplinary paradigm to problem-solving yields improved health care processes, and patient/client-centered outcomes.

Concurrents: ATHTR 804 and ATHTR 805 and PHS 809
Cross-listed with: ATHTR 500

KINES 530: Experimental Design and Methodology in Kinesiology

3 Credits

Research techniques, including methods, research design, techniques for data collection, as applied to relevant problems in Kinesiology.

Prerequisite: 3-credit 400-level statistics course

KINES 531: Issues in Athletic Training

3 Credits

Analysis of professional/academic issues related to athletic training; includes medical considerations, legal and professional developments, and current research.

KINES 540: History of Sport: Cultural and Social Dynamics

3 Credits

This seminar explores the literature, methodologies, theoretical challenges, and research questions confronting the field. KINES 540 History of Sport: Cultural and Social Dynamics (3) The History of Sport: Social and Cultural Dynamics explores the significant literature, key methodologies, and major questions currently confronting scholars of sport and leisure. The class will survey a variety of national sporting cultures and a wide range of topics. Students will read works in major research areas in the field. They will debate arguments and issues raised in those readings. They will write critiques of their readings. Students will undertake several research expeditions. The expeditions familiarize the students with the resources available at Penn State and other libraries and archives. The research expeditions also introduce them to the scholarly tools necessary for undertaking research in the social and cultural dynamics of sport. They will also produce a primary-source based research paper on a topic that they select in consultation with the professor. This course seeks to prepare graduate students to explore the history of sport. The course also seeks to develop the basic academic skills necessary for success in scholarly endeavors. Students will read, debate, and write. Writing assignments include journal article summaries, book critiques, and a research paper. The completed research paper should serve as a platform for producing a conference presentation and/or journal publication.

KINES 551: Seminar in Motor Control

3 Credits

The course will address contemporary theories and methods in motor control as reflected in recently published scientific papers.

KINES 565: Neurophysiological Basis of Movement

3 Credits

The basic understanding of neurophysiological structures and mechanisms involved in the generation of human voluntary movement.

KINES 566: Psychophysiology of Movement

3 Credits

Basic concepts and principles of psychophysiology and their application for analyses of human movements.

KINES 567: Advanced Exercise Physiology

3 Credits

Physiological changes during exercise with emphasis on the effects of physical conditioning and training.

Prerequisite: BIOL 472 , EXSCI480
Cross-listed with: PHSIO 567

KINES 575: Experimental Methods in Biomechanics and Motor Control

3 Credits

Introduces the theory and practice behind the primary experimental methods used in biomechanics and motor control. KINES 575 Experimental Methods in Biomechanics and Motor Control (3) Biomechanics and motor control share a common methodology for recording and analyzing human movement. This course is designed to introduce students to the theory and practice behind the primary experimental methods used in biomechanics and motor control. At the end of the course students should have an increased understanding of the experimental methods used in biomechanics and motor control, and experience at implementing these methods. Topics to be covered include: signal processing, electromyography, motion analysis, force measurement, anthropometry, joint kinematics in two- and three-dimensions, joint kinetics, modeling, error propagation, and scaling and dimensional analysis. Lectures will be used to introduce students to the theory behind a measurement technique. Readings will be used to provide supplementary examples of how these techniques are applied in the analysis of human movement. The techniques will be illustrated with MATLAB routines, with data sets provided so the students can experience how the data must be manipulated to provide meaningful results. Assessments will focus on students understandings of the techniques, their implementation, and interpretation of their output. The course will provide a solid foundation for students wanting to understand how the data they are reading about has been produced, and the limitations in such data. Students will also have the background required to become independent in their data collection and processing in the analysis of human movement in both biomechanics and motor control. Evaluation will include exams, class presentations and a portfolio. It is anticipated that this course will be offered every spring semester with a maximum enrollment of 15.

Prerequisite: 3-credit 400-level biomechanics or motor control class

KINES 577: Cardiovascular Physiology

3 Credits

In-depth study of the heart and circulatory system with emphasis on the effects of exercise on cardiovascular function.

Prerequisite: KINES484

Cross-listed with: PHSIO 577

KINES 579: Advanced Biomechanics of Human Motion

3 Credits

Biomechanical foundation of human movement and injury prevention.

Prerequisite: KINES484 ; MATH 141 or MATH 220**KINES 588: Scientific Writing in Kinesiology**

3 Credits

Instruct students in writing grant proposals, abstracts, manuscripts, and effective presentations in their respective scientific fields of study in Kinesology. KINES 588 Scientific Writing in Kinesiology (3) This course is intended to assist graduate students in writing grant proposals, abstracts, and manuscripts, as well as preparing effective presentations in their respective scientific field of study within the discipline of Kinesiology. Course objectives are to: 1. Increase technical proficiency in scientific writing vice a vers a grammar, sentence structure, formatting, etc. 2. Promote the ability to write effective specific aims, hypotheses, and background statement portions of a grant proposals 3. Understand the formulaic approach to writing effective scientific abstracts and manuscripts 4. Expand the ability to prepare and present effective oral communications using a Power Point format 5. Develop an understanding and appreciation for the peer review process associated with grant proposals and manuscripts Evaluation will be based on grading of the following brief writing assignments: a manuscript abstract, the Introduction section of a manuscript, the Specific Aims page of an NIH-style grant proposal, and a set of Power Point slides for an abbreviated oral presentation. The course is to be offered every fall semester. Enrollment is limited to Kinesology Department graduate students.

KINES 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students or outside speakers.

KINES 590B: Exercise Physiology Colloquium

1 Credits/Maximum of 4

Continuing colloquia in exercise physiology which consists of individual lectures by outside speakers, students and faculty.

KINES 594: Research Topics

1-18 Credits/Maximum of 18

Supervised student activities on research projects identified on an individual or small-group basis.

KINES 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

KINES 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given infrequently to explore, in depth, a comparatively narrow subject that may be topical or of special interest.

KINES 597A: **SPECIAL TOPICS**

1-3 Credits

KINES 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

KINES 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

KINES 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Preparation and presentation of materials in lecture and laboratory classes under the supervision of a full time faculty member.

Prerequisite: appointment as a Graduate Teaching Assistant in Health and Physical Education**KINES 610: Thesis Research Off Campus**

1-15 Credits/Maximum of 999

No description.

KINES 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

Labor and Global Workers' Rights (LGWR)

LGWR 510: International Labor Law

3 Credits

Seminar exploring international labor law, including its standards, reviewing bodies, procedures, information sources, remedies, and overall strengths and weaknesses. LGWR 510 International Labor Law (3) Because globalized production systems call for globalized rules for workplace rights, a body of international labor law is rapidly developing. Designed principally for global labor activists, this course equips students to evaluate the role that international labor law -- its sources, participants, mechanisms, and remedies - plays in the promotion of labor rights in the global economy. A centerpiece of the course looks

at the International Labor Organization, whose complex processes introduce students to the generally "soft" rules of international workplace regulation. Beyond the ILO, the course looks at other bodies - some global, others regional or bilateral - that require or encourage compliance with decent working standards. It also addresses how private parties can create either voluntary "codes of conduct" or negotiated framework agreements spelling out labor rights. Across all of these topics, students take up cases covering the broad range of labor struggles (affecting unions, children, women, immigrants, forced laborers, etc.). Critical to the course is the student's gaining familiarity with the surprising variety of information available on working conditions around the globe. As the course progresses, students are asked to formulate opinions on which international labor law forum holds the greatest potential to help with selected worker rights issues in selected countries. Students will review evidence suggesting that labor activists make their best use of international labor law when they link legal action to outreach, education, research, and "on the ground" organizing to enhance chances for success.

LGWR 520: Global Workers' Rights

3 Credits

This course analyzes struggles to promote workers' rights across a variety of economic, political, and geographic contexts. The stakes of such efforts are high at a time when worker movements face a barrage of new and old challenges. Political attacks, privatization, capital mobility, and automation have contributed to a decades-long decline in union membership in many of labor's traditional strongholds. Meanwhile, the vast majority of the world's workers-particularly women, immigrants, and informal workers-remain unorganized. In this course we will ask, what is the relationship between transformations in global political and economic processes, local labor control regimes and working conditions, and forms of worker resistance? What is the role of such movements in increasing the power of women, people of color, LGTBQ people, and immigrants? What catalyzes worker organizations to expand their focus from members' narrow economic interests to broader struggles for social justice, human rights, and democracy? The first unit of this course analyzes classical and contemporary theories of capitalist development, workplace control, and worker resistance. We will develop a sociological approach that understands workers not as free agents, but as actors embedded in economic, political, and cultural structures. In the second unit, we will analyze the history of the U.S. labor movement, paying careful attention to the way that work has been structured by class strata, gender, race, and region, and the implications for workers' self-organization. The third unit focuses on case studies of worker movements in Africa, Asia, Europe, and Latin America. Cross-national comparisons will provide leverage for analyzing the complex interaction between movement contexts, ideologies, strategies, and outcomes. We will study how worker movements are shaped and constrained by the states within which they are embedded, but also, how they can sometimes transform the state—for example, by pushing for democratic transitions and workers' rights policies. The fourth unit addresses pressing challenges facing the contemporary global labor movement and potential pathways forward. We will analyze innovative strategies for organizing informal workers, building global labor solidarity, and forging alliances between the labor and climate justice movement.

LGWR 530: Chinese Labor Rel

3 Credits

Since it opened its economy to private investment in 1978, China's planned economy has been turned into a market-driven economy. Relying heavily on export-oriented industries, China serves as a 'spatial fix' for Western capital, which eagerly searches for new sites of investment and business opportunities. As a result, China has become a gigantic manufacturing hub and the second largest economy in the world. The massive inflow of foreign investment, the pro-business developmental strategies of the Chinese state, and weak legal enforcement of workers' rights have rendered workers victims of economic reform. This course will examine labor relations in post-socialist China. It will cover topics such as the development of China's economic reform, the employment and working conditions of workers, trade unions and the collective bargaining system, the state's role in employment relations, the labor law system, and the role of civil society and non-governmental organizations in the country's labor relations. In addition to China, this course will focus on Vietnam (another post-communist country in Asia), and Hong Kong, Taiwan, and South Korea (three of the four Asian Tigers). It will investigate how these countries are similar to or different from China in terms of socio-economic development and labor relations. Moreover, the course examines labor relations in China and other countries by drawing upon analytical and theoretical concepts on subjects such as the state, the legal system, the economic system, class relations, and civil society.

LGWR 540: Research Methods in labor and Global Workers' Rights

3 Credits

This course introduces students to social science research methods and writing skills as they relate to workers and labor policy.

LGWR 550: Protest in the Fields: Agricultural Workers and Rural Organizing in a Global Context

3 Credits

The agricultural industry accounts for an enormous share of the global political economy, employing 1 billion people and representing 1 in 3 of all workers. Nonetheless, the organization of agricultural workers is often dismissed as too difficult, given the precarity, isolation, citizenship status, and technological displacement of these workers. This course provides a broad exploration of these global and national shifts in food production, tracing the transformations in the agricultural sector and the labor conditions of agricultural workers in the United States and across Latin America, Africa, Asia, and Europe. It considers how agricultural workers have developed new and innovative organizing strategies to demand economic and political rights. Drawing on diverse examples from the United Farm Workers to the global farmers' organization La Via Campesina (the Peasant Way), we will discuss the struggles for rural unions, environmental rights, land access, and food sovereignty. The goal of the course is to provide students with an overview of how the agricultural sector reproduces racial, economic, gender, and national inequities, while also highlighting the potential power that agricultural workers hold to reshape and reconfigure the global economic system. The first half of the course offers an overview of the political and economic history of the agricultural sector, beginning in the eighteenth century and extending to the current day. This part of the course analyzes the shift from small-family farming to industrial agricultural production, as well as particular issues such as women's access to land, the role of international agencies that regulate the agricultural sector, and the rise of organic farming. Building on these insights, students will develop

an original thesis and write a paper that explores how these changes in agricultural production unfolded in one particular country. The second half of the course analyzes how rural populations have organized for workers' rights within this shifting industry. This section of the course examines a diverse range of rural organizing efforts, from slave revolts to farmer and farmworker movements to transnational attempts to promote food sovereignty.

LGWR 560: Gender, Race and Labor in Comparative Perspective

3 Credits

This seminar takes a broad approach to gender by placing it into conversation with race and ethnicity, as well as other lines of difference and inequality, including class, nation, and age, thinking through the dynamic relationship between gender, race and labor from a variety of situated and comparative perspectives. The course begins with two orienting, interwoven perspectives: first, feminist efforts to bring women's experiences, in all their diversity, from the margins to the center of knowledge; and second, the use of gender as a category of analysis. In this way, we will understand gender as relational, in order to study and learn from the lives and experiences of men and trans people, as well as women. Lectures, discussions, and readings in this seminar will draw upon ideas from a range of academic disciplines, addressing questions around intersectionality theory, masculinities, the global division of reproductive labor, and gendered labor and the state all within the context of a transnational and always globalizing world, but with a focus on gender and race taken together as an intersectional, critical lens of analysis for understanding multiple relations of power in which we are all embedded, and which shape our experiences. Though gender is an aspect of all social life, this course pays particular attention to gendered and racialized dynamics in the workplace, in the labor process, and in everyday working lives. This course will examine changes in occupational segregation on the basis of race, gender, and immigration status, with a focus on low-wage workers and the growing informal sector. It will also investigate those workers' particular sets of challenges for recognition by the state, unions, and worker centers. And through a comparative, critical perspective, this course focuses the study of gender, race and labor across global and transnational spaces.

LGWR 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

LGWR 597: Special Topics

1-9 Credits/Maximum of 18

Formal courses given on a topical or special interest subject which may be offered infrequently.

LGWR 597C: Labor and Employment Relations in China Comparative Perspective

1-9 Credits/Maximum of 18

Since its open up in 1978 to private investment, China's planned economy has been turned into a market-driven economy. Relying heavily on the export-oriented industries, China serves as a "spatial fix" for Western capital, which eagerly search for new sites of investment and business opportunities. As a result, China has become a gigantic manufacturing hub and, the second largest economy in the world. The massive inflow

of foreign investment, the pro-business developmental strategies of the Chinese state, plus weak legal enforcement in the country have rendered workers victims of the economic reform. This course will examine labour relations in post-socialist China.

LGWR 894: Capstone Experience

3 Credits

Supervised, professionally-oriented student activities that constitute the culminating experience for the program.

LGWR 895: Internship

1-6 Credits

Supervised, professionally-oriented, off campus, non-group instruction, including field experiences, practicums, or internships. LGWR 895 Internship (1-6) The Labor and Global Workers' Rights (LGWR) internship aims to provide MPS in LGWR students with hands-on experience in labor and global workers' rights. The internship will build and reinforce the students' skills by enabling them to apply what they have learned in the classroom to a real-world labor and global workers' rights setting. As the MPS in LGWR is a professional degree, an internship in a real-world labor and global workers' rights setting is critical to students' academic and professional success. Students complete their internships with US or international labor unions or a labor-oriented organization such as a worker center, labor NGO, or labor research institute. Through the internship, students will learn about priorities, policies and practices that these organizations have regarding workers' rights and/or international labor issues. Students may also gain insight, for example, into the challenges that American unions have with building working relationships and alliances with unions in other countries while also addressing global dynamics affecting working conditions and workers' rights. Prior to the beginning of the internship, students will work with their internship adviser to develop individualized learning objectives. These learning objectives will shape a student's experience at the internship site and the types of projects the student will complete. The learning objectives will also provide the students with a metric by which they can evaluate their effort and performance.

Landscape Architecture (LARCH)

LARCH 501: Research and Writing in Landscape Architecture

3 Credits

Landscape architectural research methods and writing techniques.

LARCH 502: Intellectual History and Theory of Landscape Architecture

3 Credits

Introductory theory seminar covering the intellectual history of landscape architecture and theoretical contributions from related disciplines. LARCH 502 Intellectual History and Theory of Landscape Architecture (3) LARCH 502 is an introduction to the key intellectual themes in contemporary landscape architecture. The seminar provides a vehicle for rigorous and structured exploration of the theoretical and philosophical issues that face landscape architectural designers and planners. Specifically designed as a gateway graduate course, this course serves as an introduction to the disciplines at a graduate level and as means for new graduate students to develop independent research.

LARCH 510: Graduate Seminar in Landscape Architecture

3 Credits/Maximum of 3

Landscape architectural theory exploration through readings and discussions.

Prerequisite: graduate standing in the department of landscape architecture

LARCH 515: Design and Theory I: Introduction

5 Credits

Introductory landscape architectural design and applied theory for MLA students. LARCH 515 Design and Theory I: Introduction (5) LARCH 515 is the first of a four-class sequence of design studios at the core of the professional MLA design program. The design studio is an active learning setting where principles discovered in lecture or seminar classes are subject to experiments in the form of design projects. It is a class setting where solutions to complex problems are synthesized and tested based on information gathered in earlier and concurrent classes.

LARCH 550: Master of Landscape Architecture Project Studio

6 Credits

The final capstone studio for students completing the Master of Landscape Architecture.

Prerequisite: LARCH540

LARCH 551: Final Culminating Experience Proposal

1 Credits

The Final Culminating Experience Proposal course provides the opportunity for a student to develop an area of inquiry within the discipline of landscape architecture to be explored toward the production of a capstone project as the final culminating experience of the Master of Landscape Architecture degree. The student is expected to generate and refine research questions, develop aspects of extant questions, develop and test design ideas, or otherwise enhance his or her research interests.

LARCH 552: Final Culminating Experience Production

4 Credits

Following approval of the FCE proposal (LARCH 551), students shall proceed to implement their research project based on their prepared schedule. In this course students shall complete the steps as outlined in their proposal with the assistance of faculty advisors. It is expected that this work shall last the duration of one semester minimum. Additional time to complete the research may be required based on topic and resources. Students are expected to document progress in the manner appropriate to their investigation topic, and to present their findings in progress on a regular basis.

LARCH 553: Final Culminating Experience Documentation & Presentation

2 Credits

In this course students shall prepare final documentation of their research-based design project, and make a public presentation/defense of their project's relevance, research/inquiry methods, design approach, and findings. LARCH 553 is the third of three courses that will lead to the student's final culminating experience (FCE) for the Master of Landscape

Architecture degree. A successful FCE, typically a capstone project, will research in the frontiers of knowledge in the field of landscape architecture. The form and specific criteria for a capstone project will be determined by the student and adviser, in consultation with the landscape architecture graduate professor-in-charge. This documentation and presentation course is an advanced landscape research or research and design course which will culminate in the presentation of scholarly products required for the conferral of a Master of Landscape Architecture degree.

LARCH 590: Colloquium

1-3 Credits/Maximum of 6

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

LARCH 596: Independent Studies

1-9 Credits/Maximum of 9

Independent study opportunities open for graduate students covering topics which fall outside the scope of formal courses (non thesis).

LARCH 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

LARCH 600: Thesis Research (On Campus)

1-15 Credits/Maximum of 999

No description.

LARCH 815: Grad Studio I

6 Credits

LARCH 815 is the first of a three-course sequence of design studios at the core of the professional M.L.A. design program. Students will develop the fundamental concepts and basic skills of landscape architectural design and explore site design through expanded complexity of site and program. Students are presented with design projects that include extensive and complex programs and a broad range of site scales, existing conditions, and contexts. Projects also explore the extent and complexity of pedestrian and vehicular circulation. These expanded site and program considerations require students to consider a broad range of design responses while building skill in site design. Throughout the semester, students will develop skills in graphic representation and visualization to explore design ideas and develop presentation graphics. The subsequent challenge for students will be the development of design processes necessary to integrate site and program understandings into unified, successful design.

Prerequisite: LARCH515

LARCH 816: Grad Studio II

6 Credits

LARCH 816 considers the broader landscape and systems within the landscape. Students learn to work at the broader landscape scale, making informed planning, design and management recommendations at that level, and enlightening site-scale design with a regional perspective.

Students begin exploring ways to understand and address issues of regional context. Projects include an emphasis on regional analysis, site and program analysis, and site design in the regional context. Studio work involves research and report writing and medium- to large-scale projects where site design and program are directly influenced by regional factors. Topography, geomorphology, land use, transportation, regional ecology, demographics, landscape history, visual analysis, etc., are covered, all bound into current technological formats using such tools as Geographic Information Systems. Students explore ideas about landscape-scale conservation, linkages, and recreational programming - important types of regional-scale work with which landscape architects are involved. They apply knowledge of the landscape in considering public planning, design, and management interventions, including exploration of alternatives for landscape conservation and recreation. Students become involved, through community outreach projects, with interactive and real (e.g. sometimes messy) public dialogue that may help build community-wide enthusiasm for a landscape project of regional significance. Throughout the semester, students will continue to develop skills in graphic representation and visualization to explore design ideas and develop presentation graphics.

Prerequisite: LARCH520

LARCH 817: Grad Studio III

6 Credits

LARCH 817 provides an overview of community and spatial design that accommodates civic and public functions while addressing social and environmental imperatives. It also expands on site design and programs that creatively reconcile community-based (i.e. residential and/or public space) agendas. In support of focused explorations of community-oriented design, students are expected to draw on their knowledge of regional and landscape systems from LARCH 816, as well as site design in LARCH 815. In designing public spaces that lie at the heart of thriving communities, students are also expected to draw on technical skills in grading, materials, and planting acquired in their implementation courses. Throughout the semester, students will continue to develop skills in graphic representation and visualization to explore design ideas and develop presentation graphics.

Prerequisite: LARCH530

LARCH 835: Grad Implementation I: Grading

3 Credits

Computer Applications for Site Analysis and Design. Geometrics: In order to perform landform manipulation, students must be able to efficiently acquire and process physical information about a site and are required to understand a suite of measurements. This course will first provide an overview of the digital and paper data sources available to landscape architects. Students will develop skills in manipulating or processing these data in order to comply with the requirements of site design. The course will also provide the measurements and formulae required for students to efficiently and accurately manipulate landforms. Landform Manipulation: One of the most critical skills landscape architects must acquire as designers is the ability to design landforms to accommodate changes in use and to translate their design ideas into dimensionally precise topographic representations of their designs. This course provides the knowledge for students to complete this process. Beginning with a single site element, students are expected to explore the suite of opportunities to place and modify a site to fit a single site element. Increased complexity is added to the suite throughout the

remaining portions of the semester, thus enabling students to balance the opportunities and constraints presented by each individual design element and the overall site design. Site Systems: Building on ecological components of the curriculum, this course provides the first site specific and physical understanding of site systems critical to every landscape architect's design. Students will primarily focus on the major site features as related to site drainage, such as soil, topography, and surface geology, but will also be expected to recognize regional context in their designs. Computer Applications for Site Analysis and Design: A central component underlying the instruction of the course is providing students with a suite of computer tools. Course objectives: a) To assist in initial efforts in acquiring and processing site data; b) To perform calculations such as cut and fill, spot elevations, and slope calculations; c) To visualize and complete manipulation of landforms; d) To understand the interaction of physical site features on individual sites (e.g., soil and topography); and e) To communicate their final site designs according to professional standards

LARCH 836: Grad Implementation II: Materials

3 Credits

The landscape architect calls upon a rich array of materials to construct the built elements of landscape walls, ground surfaces, overhead structures, and furniture systems. The functional success and durability of many historical and traditional construction methods is based on a learned appreciation of the qualities and behaviors of materials in use in the landscape. Students develop understanding of the fundamental structural qualities of materials and use that knowledge to devise and illustrate their own design details. The same understanding of material behaviors will be used to investigate the qualities of novel construction materials, and will guide the development of construction details that respond to new constraints and opportunities. The main focus of LARCH 836 will be on materials and construction detailing, with emphasis on techniques appropriate for an array of design situations. Representation of design ideas using computer-aided-drafting is expected in this class.

LARCH 837: Grad Implementation III: Plants

3 Credits

This course addresses the applied principles, tools, and techniques of planting design implementation, with a focus on landscape planting methods and technically proficient documentation. It relies on students having achieved foundational planting design knowledge and abilities in prior design studios. Proceeding briskly through site and contextual analysis and conceptual design, we will concentrate on methodical design development, investigation of planting implementation and management methods, and preparation of planting contract documentation. Upon successful completion of the course, students will have achieved proficiency in planting design implementation as integral to the overall design process and vital to realizing goals for landscape performance, aesthetics, site functionality, and broader social and environmental values.

LARCH 838: Grad Implementation IV: Stormwater

3 Credits

This course is one of four graduate-level design implementation offerings that focus upon the more technical aspects of landscape architectural practice. By means of lectures, studio problems, assigned readings, and computer courseware, LARCH 838 will present the principles and

techniques of: - Advanced Landform Design and Site Grading- integration of landform and structure through iterative grading design process; water flow and surface drainage. - Site Systems and Stewardship - soil, water, and vegetation interactions and ecology; site protection; site systems management; environmental responsibilities and stewardship. - Hydrology and Stormwater Management basic site hydrology; overview of hydrology and stormwater management concepts, infiltration; surface runoff calculations, surface and subsurface drainage systems design. - Production of technical drawings using computer-aided-drafting is expected in this class

RECOMMENDED PREPARATION: LARCH 835

Language and Literacy Education (LLED)

LLED 500: The Reading and Writing Classroom

3 Credits

Analysis of reading and writing processes and the development of integrated language arts programs for elementary schools.

Prerequisite: LL ED400

LLED 501: Teaching Writing in Elementary and Secondary Schools

3 Credits

In depth examination of writing development and the development of writing components of language arts programs K-12.

Prerequisite: LL ED500 or LL ED512

LLED 502: Studies in Literature for Children

3 Credits

Study of various genres of children's literature from various critical perspectives; emphasis on role of literature in children's lives.

Prerequisite: LL ED402

LLED 512: Teaching Language, Literacy, and Literature in Secondary Schools

3 Credits

Collaborative inquiry into the curricular design and experience of language, literacy, media, and literature in adolescents' personal and social lives.

Prerequisite: LL ED412W

LLED 520: Literature for Adolescents

3 Credits

Critical study of adolescent literature, its diversity of cultural voices, and designs for its use in secondary school classrooms.

Prerequisite: LL ED420

LLED 541: Adolescent and Children's Literature Related to Ethnic and Social Issues

3 Credits

Literature, K-12; study of literary symbolism, ethnic literature, issues, e.g., sex, death, adoption, divorce in trade books.

Prerequisite: LL ED402

LLED 542: Issues in Literacy Education

3 Credits/Maximum of 6

Discussion of philosophical, sociological, historical, and curricular issues in literacy education.

Cross-listed with: CIED 542

LLED 545: Literacy And Language Assessment For Instructional Decisions

3 Credits

Diagnosis of reading difficulties; genesis of reading problems; achievement, diagnostic, and capacity tests; application in simulation activities.

Prerequisite: EDPSY450 , LL ED500

LLED 550: Theory and Practicum in Assessment and Remediation of Reading Difficulties

3 Credits

Links theory and practice in supervised practicum involving design and analysis of appropriate assessment and instructional procedures for elementary and secondary students.

Prerequisite: LL ED500 , LL ED545

LLED 561: Cultural Pluralism in Children's and Adolescent Literature

3 Credits

Reading/discussing literature from multicultural/critical multicultural lenses and how this impacts literacy. LLED 561 Cultural Pluralism in Children's and Adolescent Literature (3) LLED 561 is a critical exploration of literature that addresses multicultural issues and their functions in the classroom. Emphasis is on cultural diversity in children's lives. The course focuses on four main areas. The first of these areas revolves around the concepts of multiculturalism and critical multiculturalism and how they serve as lenses through which students can ask questions about society as represented in literature. It addresses what multicultural literature is, who writes multicultural literature, and how this genre of literature serves as a window into and a mirror of culturally diverse societies. Race/ethnicity, gender, class, disability and cultural authenticity in multicultural literature are discussed. The primary objectives of the course are to enable students to expand their strategies for reading culturally diverse literature, become familiar with resources related to multicultural literature, explore cultural, literacy and socio-political issues related to Children's/adolescent literature and to consider the role that multicultural literature plays in a literacy curriculum.

LLED 563: Myths and Folktales in Children's Literature

3 Credits

An in-depth study of myths and folktales shared with children and how these stories are remade and disseminated today.

Prerequisite: LL ED402

LLED 564: Writing for Children

3 Credits

Supervised workshop in the craft and techniques of writing picture books, short stories, longer fiction, and nonfiction literature for children.

LLED 564 Writing for Children (3) This is a course in creative writing for those who wish to write for children. The course is intended to be creative practice in the art, craft, and techniques in a wide range of genres in children's literature: poetry, picture books, picture story books, short stories, and longer works. Students will learn about the field of literature for children, namely, how to develop their ideas into appropriate literary forms for the various age groups. Students will read and discuss contemporary writers and examine their work, and get responses to their own writing.

Prerequisite: LL ED502

LLED 567: Politics of Bilingual Education

3 Credits

To critically analyze the contemporary and historical political context of an education that is bilingual and bicultural.

LLED 568: Doing Research in Children's Literature

3 Credits

An examination of research traditions used to frame research in children's literature studies and preparation to write the master's paper.

Prerequisite: LL ED402

LLED 580: Media Literacy, Language, and Literacy in Schools

3 Credits

Theories of media literacy, issues of non-print technology in language and literacy.

Prerequisite: LL ED480

Cross-listed with: CI 580

LLED 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

LLED 594: Research in Language and Literacy Education

3 Credits

Cooperative design and study of research in language and literacy education.

Prerequisite: C I 400 or EDPSY400

LLED 595: **SPECIAL TOPICS**

1-6 Credits/Maximum of 6

LLED 595A: Practicum: Remedial Procedures and Diagnosis

3-6 Credits/Maximum of 6

Advanced practicum; diagnostic testing and remedial instruction of more severe types of reading disability; supervisory experiences, if appropriate.

Prerequisite: LL ED545

LLED 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

LLED 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

LLED 870: Teaching Reading & Writing to K-12 English Learners

3 Credits

This course prepares students to develop reading and writing instruction that supports the academic development of school-aged English learners (ELs) with a primary focus on reading. An overarching goal of the course is to promote an understanding of learning language as a process of expanding linguistic resources to engage in various contexts, with different participants/audiences and for a variety of purposes. Class participants will critically analyze reading/writing theories and research in reference to bilingual/ESL reading/writing practices. As part of this overview, students will analyze and evaluate current second language (L2) reading/writing approaches and strategies in home language (L1) and L2 literacy development. Thus, the course content emphasizes the theoretical underpinnings of and practical applications for integrating language and literacy instruction for diverse ELs.

Latin (LATIN)

LATIN 510: Latin Seminar

3-6 Credits/Maximum of 6

No description.

LATIN 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

Latina/o Studies (LTNST)

LTNST 571: Latina/o Studies: Foundations in the Field and Its Teaching

3 Credits

A foundation in the field and strategies for teaching Latina/o Studies to undergraduates. This course provides a foundation in U.S. Latina/o Studies Literature and its contexts, with two separate but related goals. The first is to get a grasp on the U.S. Latina/o Studies canon that integrates humanities and social science approaches in order to analyze critical historical contexts that have shaped the emergence and evolution of the field of Latina/o Studies in U.S. higher education and academia, such as early colonial enterprises in the South and the Southwest, Spanish and U.S. imperialism, the Chicano and Young Lords movements during the 1960s, immigration patterns from the Caribbean and Latin America, government policies towards Latinos, contemporary rural and urban movements, etc. The second goal is to explore systematically pedagogical theories and practices in Latina/o Studies and critical race scholarship more broadly, in order for students to become conversant in the theoretical debates that underlie the design of curriculum and classroom practice in Latina/o Studies at the undergraduate level. The course will incorporate some of the major lines of research in Latina/o Studies from different disciplines (such as History, Anthropology, Ethnic Studies, Gender and Sexuality Studies, and Linguistics) in order to address some of their most relevant discussions, internal critical debates, and major schools of thought. Students will also engage with other forms of cultural production, including visual culture, theater and performance, and music, among others. The seminar will provide graduate students a solid foundation in the development of a very timely and marketable research and teaching minor.

Cross-listed with: SPAN 571

Law, Policy, and Engineering (LPE)

LPE 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects with a professional orientation, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

LPE 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester

LPE 851: Foundations in Public Law

3 Credits

Students with non-legal backgrounds will develop a fundamental understanding of public law, meaning legislation and regulation, and the mechanisms by which public law regulates engineering, science and technology: how the executive, legislative, and judicial branches of government interact to form science and technology policy, how administrative agencies and regulations implement that policy, and how judicial review of legislation and regulation affects policies, regulations, and systems. Students will be exposed to the following legal topics: constitutional law, statutory passage and interpretation, administrative

regulations, how administrative regulations are analyzed by the judicial branch, and the role of the Supreme Court of the United States. Case studies will be used to show examples of how legislation and regulation affect engineering and other non-law fields, including how agency regulations impact engineering work, business, and culture; the role of technical experts in agency activities, and how notice-and-comment allows for public feedback on proposed regulations. After successfully completing this course, students will have an in-depth understanding of how technical and scientific experts within the government can impact policy and how experts outside of the government are regulated by that policy.

LPE 852: Foundations in Private Law

3 Credits

Students with non-legal backgrounds will use case studies grounded in science, engineering, and other disciplines to develop understanding of the fundamentals of private law as they apply to engineering, science, and technology. Students will be exposed to the following legal topics: contracts, employment/labor law, mergers and acquisitions (M&A), anti-trust, intellectual property (IP), torts, fiduciary duties, and criminal law. Case studies will show how legal issues arise in engineering, science, and technology contexts and affect policy. This includes developing a better appreciation and understanding of various stakeholders including customers, companies, government agencies, and communities. Students will learn to better identify and anticipate legal issues in engineering, science, and technology and understand how to minimize legal risk.

LPE 853: Engineering, Law, and Policy Systems

3 Credits

This course provides a broad exploration of the relationship between engineering, policy, and law. From driverless cars to AI-powered systems, engineering is transforming public and private spaces. As these new technologies leave the lab and operate in new spaces, each new technology represents a system within that larger, higher-order system. The transformation of these spaces and the interaction of these once-separate systems will be shaped by, and in turn will shape, the public policies of local, state, national, and global policymaking systems. This interdisciplinary course has two objectives. First, it considers the classic engineering problem of integrating subsystems into a larger, higher-order system. In this class, the larger system includes not only other physical systems in the operating space, but also social, legal, and political systems. Second, it considers traditional legal and policymaking institutions as constrained optimization problems. This course identifies the legal and political constraints engineering solutions must satisfy in order to come online.

Cross-listed with: INTAF 853

LPE 854: Engineering, Law, and Technology Policy Practicum

3 Credits

In this class, we bridge technology theory with technology policy practice. We begin the semester by asking the "big" normative questions of innovation: what kinds of technology are we building? What engineering and ethical principles are we applying? Is this "progress"? How is law helping (or not helping)? Next, using case studies of "hot topics" in technology policy, we apply these ideas to current debates. Finally, through the development of an interdisciplinary team project, the lessons

from the first two parts of the class are applied, and as the culminating experience of the Master of Engineering program in Engineering, Law and Policy (MELP), engineering students will apply and integrate their knowledge on strategic science and technology policy, regulatory concepts, and systems thinking to the real world policy issue chosen for the team project. The projects are tailored to meet the current research needs of particular federal and state lawmakers and agencies based on their legislative and regulatory agendas for the year. Students will analyze technology and policy options and conceive, design, and execute a technology and policy research project, taking into consideration the political, social, and institutional context of technological systems. The deliverables of the course will be a formal oral presentation of the team project, a public-facing technology tool, and a policy research paper written for relevant policymakers, seeking to assist them in their policy decision-making process. This will require students to reconcile the engineering and technical realities and constraints of the projects as well as the legal implications, stepping into the shoes of a policymaker. Possible policy coverage and project areas include connected health; consumer/ investor protection in security and privacy; disinformation, governance, and tech literacy; internet availability and net neutrality; sustainability and ethics in computing design; the Internet of Things and the right to repair; machine learning/ AI suitability; tech competition; computing history; and tech workforce development.

LPE 896: Individual Studies

1-9 Credits/Maximum of 9

Creative projects with a professional orientation, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

LPE 897: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject with a professional orientation that may be offered infrequently.

Leadership Development (LEAD)

LEAD 501: Leadership Across the Lifespan

3 Credits

Analysis and application of models, theories and strategies for developing an individual's full leadership potential at different life stages. LEAD 501 Leadership across the Lifespan (3) LEAD 501 explores and analyzes the requirements for positive leadership of the self and others, recognizing the way people change along the way from early adulthood to old age. Students will be introduced to the various components of the self-leadership, including personal meaning, optimal experiences (flow), emotional intelligence, moral development, how a leader's (and his/her followers') life stream of biographic and deomgraphic elements influence leadership processes, and followers' perceptions the leader's behavior. Students will learn how to display psychologically empowering positive leadership based upon information obtained through discussions, 360-degree and moral development leadership assessments, participation in field projects observing leadership "in vivo," analysis of relevant popular movies by applying theories of leadership and adult development, and readings. Emphasis in this course is placed on learning from the life streams of "real world" leaders to bring to life the material covered in the course. As the course progresses, new knowledge and skills are

integrated into a more sophisticated framework for understanding positive leadership across the lifespan.

LEAD 557: Leadership Models and Methods

3 Credits

Design, analysis and application of leadership models and research methods for solving organizational problems. LEAD 557 Leadership Models and Methods (3) LEAD 557 provides masters'-level graduate students with an initial understanding of the process of research methods, particularly within leadership and management-related disciplines and in organizational contexts. Students will survey a variety of leadership models and their application to leadership research and practice. They will learn how to evaluate and design research studies and apply them in organizational context in their consulting work, debate ethical and philosophy of science issues, and solve focused organizational problems by applying the scientific method. Emphasis in this course is placed on "learning by doing" in order to gain knowledge of how leadership theories are formulated, how data are analyzed to test theories, and how conclusions about data and theory are drawn. Students learn by critiquing a variety of key leadership models, identifying real organizational problems and applying the skills of theory and hypothesis formulation, measurement, sampling, and study design. Students learn techniques of data collection and analysis using SPSS (Statistical Package for the Social Sciences), and how to write clear and concise research papers. As the course progresses, new knowledge and skills are integrated into a more sophisticated framework for understanding how leadership models and methods can solve organizational problems.

Prerequisite: LEAD 501 , LEAD 555 , and LEAD 556

LEAD 561: Dynamic Communication in Leadership Contexts

3 Credits

Articulating and promoting a vision; facilitating interaction and communicating with groups; theory and techniques of persuasion. LEAD 561 Dynamic Communication in Leadership Contexts (3) LEAD 561 is an advanced communication course the emphasizes leadership development and communication competency. Theories and models of interpersonal communication, transformational and charismatic leadership, group dynamics persuasion, and creativity and innovation are addressed in relation to communication practice. Student evaluation methods will include individual and team projects, presentations, and essays. The course will be offered annually and is a required course in the Master of Leadership Development program.

LEAD 819: Developing Creative High Performance Organizations

3 Credits

This course focuses on how to create high performing organizations based on models provided by business, science and the arts. We will examine the key assets that these disciplines bring and show how to apply them to business activities. For example, it has been shown that improvisational models from music are highly relevant to new product development. Course activities will include a discussion of the readings from relevant academic research in the business field. We will discuss the philosophy of aesthetics, analyze cases, and review original works. We will also listen to short lectures by practicing artists, musicians, actors, scientists, and writers. Together, these activities will help students to develop strategies to help their organizations attain higher levels of performance. This course is a graduate elective for MBA students and

could also be taken by other students (such as Leadership students) if it meets their degree requirements. The way the course will run: This course will be run as a graduate seminar designed to maximize the learning of the members of the group including the instructor's. We will learn about each of the topics noted above through a variety of means. Our interaction will include general discussions, lectures, case discussions, exercises, small group meetings, and on-line chats. We will have invited speakers for the class representing the arts, music, science and business.

Prerequisite: 6 graduate credits in business
Cross-listed with: BUSAD 819

LEAD 855: Full Range Leadership Development

3 Credits

Leadership is one of the world's oldest preoccupations. Since the beginning of civilization, prophets, kings, rulers and managers have struggled to find answers to an important question: Why do most leaders or managers elicit merely competent performance from their followers, while a select few inspire extraordinary achievement? Given increased globalization, diversity, restructuring, e-business and innovation in today's business environment, finding answers to this question is important for maintaining organizational competitiveness. The purpose of this course is to provide answers to this question by identifying traits and behaviors associated with outstanding leaders, explaining how they get results, and why their leadership often exceeds all expectable limits. This course is designed to introduce students to a) behaviors associated with outstanding leadership, b) social learning and cognition in organizations as a context to promote outstanding leadership, and c) leadership development as a strategic intervention to enhance individual, group, and organizational motivation and performance. The course will be run as a graduate seminar. We will interact through Web site technology, general group discussions, team projects, lecturettes, case discussions, exercises and videos. Class sessions will focus on issues raised by the readings, cases, and issues relevant to students' organizational experiences. A portion of the class time may be set aside for the coordination of team projects.

Prerequisite: MGMT 501 or LEAD 501
Cross-listed with: BUSAD 855

LEAD 856: Diversity Leadership

3 Credits

In this course students will explore the theory and practice of diversity leadership through experiential exercises, video and didactic presentations, small group and class discussions, and the analysis and application of models, theories, and strategies for managing an increasingly diverse workforce and customer base.

Prerequisite: LEAD 501 or MGMT 501
Cross-listed with: BUSAD 856

LEAD 862: Strategic Leadership

3 Credits

LEAD 862 explores and analyzes the requirements for effective strategic leadership in organizations. Strategic leadership examines the role of executive leaders and their effects on organizations. The primary role of executives is to foster financial success and create wealth in organizations. This course is designed to provide students with an understanding of the requirements for effective strategic

leadership in organizations as assessed by the balanced scorecard. The challenges of strategic leadership involve strategic planning, marketing products and services, selecting and training employees, facilitating organizational learning and development, and developing systems to support operations, innovation and human resources. These outcomes are lead indicators of financial success and wealth creation in organizations. Students will be given an overview of the various elements of the strategic leadership system, including organizational context/environment, leader's life stream of biographic and demographic elements influencing leadership, and followers' perceptions the leader's behavior. Emphasis in this course is placed on learning from "real world" senior managers/administrators to enhance the practicality and usefulness of the material covered in the course. As the course progresses, new knowledge and skills are integrated into a more sophisticated framework for understanding strategic leadership.

Prerequisite: (LEAD 501 or MGMT 501 or PSY 532) and LEAD 555 or BUSAD 555

LEAD 863: Ethical Dimensions of Leadership

3 Credits

This course in leadership ethics is designed to examine ethical challenges faced by leaders. The course provides an historical overview of the study of ethics, including the major ethical theories advanced in both Western and non-Western traditions with a particular emphasis on the major alternatives available for the ethical leader in the twenty-first century.

LEAD 882: Social Entrepreneurship and Community Leadership

3 Credits

This course uses entrepreneurial and leadership skills to craft innovative responses to social needs. Entrepreneurs are particularly good at recognizing opportunities, exploring innovative approaches, mobilizing resources, managing risks, and building viable, sustainable enterprises. Entrepreneurial skills are just as valuable in the social sector as they are in for-profit business. Social Entrepreneurship aims at social impact but does not exclude economic wealth creation. Therefore it is not limited to the non-profit sector. Despite a sustained economic boom in this country, numerous social problems remain and some seem to be getting worse. The course will provide an overview of business leadership and entrepreneurship principles for both profit and non-profit organizations whose products and services are designed to create social value.

Recommended Preparation: Completion of 24 credits in the MLD program for MLD students; Other programs 6 graduate credits or by permission of instructor.

Cross-listed with: BUSAD 882

Learning Design and Technology (LDT)

LDT 505: Integrating Mobile Technologies into Learning Environments

3 Credits

Research on learning with mobile computers and models for mobile computer integration for K-12 schools, community organizations, and universities. LDT 505 Integrating Mobile Technologies into Learning Environments (3) Integrating Mobile Technologies into Learning Environments examines how people use and learn with mobile computers

in their everyday lives around the world. The focus is on the uses and educational possibilities of mobile computers to serve as tools that can support people in various learning environments (such as schools, colleges and universities, training and professional development, museums, libraries, homes, and workplaces). Topical areas are covered that build from empirical studies about how people learn with mobile forms of computing: (1) how people use mobile computers in their everyday lives, (2) key theoretical perspectives on how people learn with mobile computers, and (3) research findings on integrating mobile computers into the design of learning environments. In addition to activities for the whole class, students select one course strand to support their own interests and final project. The course strands are tailored to students' interest and can include (1) integrating mobile computers to support families and young people, in and out of school, (2) integrating mobile computers to support adult learners in higher education (includes distance education), (3) integrating mobile computers to support workforce development, vocational education, professional development, certification achievement, and on-the-job training, and (4) integrating mobile computers within community-based organizations, personal hobbies, and cultural institutions.

LDT 525: Instructional Design Models, Strategies, and Tactics

3 Credits

Application of instructional design models and design of appropriate instructional strategies and tactics.

Prerequisite: LDT 415

LDT 527: Designing Constructivist Learning Environments

3 Credits

Designing learning environments based on constructivist principles of learning that provide modeling, coaching, and scaffolding.

LDT 537: Power, Politics, and Equity in Learning Environments

3 Credits

This course examines contemporary research that addresses questions of power, politics, and equity in learning environments and processes. The course is strongly rooted in the sociocultural tradition of the learning sciences. Students will discuss conceptual and methodological approaches and apply them to contexts relevant to their own research. Particular attention will be given to learning environments and their design, a central research practice of the learning sciences. The course considers ramifications of power for design work in learning research. Part 1 of the course explores what it means to think about power, politics, and equity in learning and includes reflection on personal experiences as an entryway to the course topic. Part 2 surveys a range of theories and empirical studies that locate power, politics, and equity in learning in various ways. For example, the course considers how learning intersects with identity processes, ideology, and social movements. Part 3 approaches questions of learning environment design more deeply, asking in what senses designs and technologies have politics and how to engage in design with power, politics, and equity in mind.

LDT 544: Video for Instruction, Training, and Research

3 Credits

Theory, design models, and methodologies supporting the use of video in a variety of learning environments.

Prerequisite: INSYS447

LDT 549: Current Topics in Emerging Technologies

3 Credits

An in-depth seminar on the instructional and training design implications of specific new technologies as they emerge.

LDT 550: Learning Design Studio

3 Credits/Maximum of 12

Examines a range of skills, processes, and theories for designing and developing interactive educational materials.

LDT 553: Managing and Consulting for Instructional Development

3 Credits

Knowledge and skills in managing and coordinating an instructional development project and consulting with subject matter experts and clients.

Prerequisite: INSYS525

LDT 566: Using Technology to Enhance Learning Process

3 Credits

Technology has a long history of supporting thinking and learning both within and outside of school settings. With this history comes some controversy over * the utility of different technological tools, * the ways that different technologies should be used to support learning, and * the tradeoffs associated with different approaches to using technology to support learning. Thus, it is important to be strategic with and critical of technology use and build on empirical research to design tools and learning contexts that better meet the needs of learners. The main aim of this course is to help students understand that technology use has important tradeoffs that need to be considered when designing technology-enhanced learning contexts. The course will examine the costs and benefits of technology use and cover emerging research topics on technology-enhanced learning. The course will connect learning theories with concrete examples of how technology can be used to enhance important learning processes. Building on these course topics, students will be expected to propose concrete ways that they can change existing design/teaching processes to mitigate problems associated with technology use and enhance learning processes.

LDT 574: Applied Qualitative Research for Work Practice, Innovation, and Systems Design

3 Credits

Investigates qualitative research paradigms and methodologies; develops skills in use of ethnographic methods in work practice, innovation and systems design.

Prerequisite: ADTED550

LDT 575: Designing Experimental Research in Learning, Design, and Technology

3 Credits

Designing research studies in Learning, Design, and Technology of a quantitative and experimental nature, which results in a research proposal.

LDT 576: Design-based Research Methods, Applications for Educational Research

3 Credits

The course focuses on design-based research methods in education.

LDT 577: Computer Supported Collaborative Learning

3 Credits

CSCL is an interdisciplinary branch within the Learning Sciences that focuses on the study of social learning processes with and without technology, and the development and evaluation of tools to improve the practice of collective cognition in learning contexts. CSCL also promotes a shift in mainstream education from a practice that prioritizes individual knowledge acquisition of inert forms of knowledge about things, to one that prioritizes higher forms of psychological function, such as control over learning processes, artifact creation, and collaborative knowledge building. The CSCL community is made up of a diverse collection of researchers and includes design and lab-based studies. As such, this class will provide an overview of a variety of literature in CSCL and take a collaborative approach towards exploring this exciting field. We will use collaborative technologies to discuss and build understanding of key CSCL theories, learn about CSCL methodologies, and create new tools, artifacts, and designs to articulate our developing understanding.

LDT 581: Theoretical Foundations of Learning, Design, and Technology

3 Credits

Analysis of theoretical foundations of the instructional systems (systems and cybernetics, communications, cognitive psychology, sociological, constructivist, ecological) for doctoral students.

Prerequisite: PH.D. or D.ED. candidacy

LDT 583: Survey of Research in Learning Sciences and Technology

3 Credits

Analysis and evaluation of research in domains of learning sciences and technology. This course reviews the empirical research literature from the Learning Sciences and Technology fields. Students will gain experiences reading and understanding research papers to understand modern perspectives on the theories, models, methods, and tools used in the learning sciences.

Cross-listed with: SCIED 583

LDT 586: Diffusion and Adoption of Innovations and Change

3 Credits

Understanding change process in educational contexts, comparing various models, tailoring them to individual needs, and creating personalized model of change.

LDT 594: Research Topics

1-18 Credits/Maximum of 18

Supervised student activities on research projects identified on an individual or small group basis.

LDT 595: Internship

1-18 Credits/Maximum of 18

Supervised off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

LDT 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

LDT 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

LDT 597B: ****SPECIAL TOPICS****

3 Credits

LDT 600: Thesis Research

1-15 Credits/Maximum of 999

NO DESCRIPTION.

LDT 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

NO DESCRIPTION.

LDT 602: Supervised Experience In College Teaching

1-3 Credits/Maximum of 6

NO DESCRIPTION.

LDT 610: Thesis Research Off-Campus

1-15 Credits/Maximum of 999

NO DESCRIPTION.

LDT 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

NO DESCRIPTION.

LDT 824: Making and Education: Fabrication, DIY and Content Creation in Learning, Design and Technology

3 Credits

This course will explore the historical roots of maker education and hobbyist learning activities, as well as the changing landscape of making, content creation and constructionist activities in formal and informal

learning environments. The purpose of the course is to build upon students' knowledge, skills and understanding of different uses of historical, contemporary and emerging physical, digital and non-digital tools and technologies and their affordances for teaching and learning in formal and informal contexts.

LDT 832: Designing e-learning Within Course Management Systems

3 Credits

Practical design of instructor-facilitated online lessons taking advantage of the affordances and within the constraints of course management systems. LDT 832 Designing e-learning Within Course Management Systems (3) This course is intended for professionals in corporate and non-profit settings including those in online cyber schools, but will be informative for anyone designing online learning. Participants in this course learn to use the internal features of a CMS and to find and incorporate external tools (i.e., go outside the CMS, create something, bring it back inside). By controlling access and records, course management systems (CMS) provide a safe haven for online learning that protects the learners, the teachers, and the institution. But as closed systems, the CMS limits learning approaches to what is available within the CMS. This course requires directed hands-on experience with a CMS to develop understanding with the capability and limitations of management systems. Students who successfully complete this course will have an expanded repertoire for designing, developing, and implementing learning online and a skill set for integrating new tools and approaches into their instruction. This course provides professionals in corporate and non-profit and other settings with hands-on experiences with online management systems to gain command of, and extend its use. Topical areas that you will read, discuss, and write about include the affordances and constraints of Course Management Systems, the tension between safety online versus access to open resources, mandates (i.e., FERPA and accessibility issues), the current and future forms of virtual classrooms, instructional design models for e-learning, the role of lesson plans as learning objects, evidenced-based didactic and constructivist delivery strategies including project-oriented approaches, problem-based learning, and case-based learning, and e-learning assessment. Subsidiary topics covered include games, simulations, mobile learning, and other breaking current topics related to online course design and delivery. The role and significance of social learning approaches in online courses are emphasized as an essential dynamic in current online courses (e.g., asynchronous discussions, learning communities, and community of inquiry). You will be asked to prepare and then moderate a class discussion and also to participate in an external professional learning community. A central outcome of this course is to actually design effective learning in a CMS. The final course project consists of a learning module that you develop within a course management system of your choice on a topic of your choice for an audience of your choice, and includes serving as instructor or facilitator of that module. You will also review lessons developed by others to provide formative feedback on those modules.

LDT 835: Supervised Field Experience in Online Instruction

3 Credits

The Supervised Field Experience in Online Teaching is a practical application of contemporary skills and practice related to online or hybrid (residential + online) education. This field experience allows students to apply and demonstrate their skills in designing, developing, and delivering online instruction to an authentic audience. The supervised field experience synthesizes and applies online program instruction in

a real-world context. The experience can be tailored and differentiated to match the students' professional goals related to their desired role(s) within an educational system. The student's online teaching field experience will contain adequate rigor that both demonstrates practical application of skills learned during Learning, Design, and Technology certificate or degree coursework as well as provide new opportunities for professional development and growth.

LDT 843: Learning Technologies for Good and Evil

3 Credits

This course starts from the assumption that good outcomes of new technology for education and society are never guaranteed but rather that the use of technology for learning, or any other purpose, always entails ethical tensions—a struggle between "good" and "evil." The course provides a practical angle on these issues for learning technology designers, educators, and researchers. The course is organized into three parts. Part 1 provides initial conceptual frames for thinking about ethical issues in technologies for education and learning, including basic moral theory, utopian/dystopian thinking, and guiding values. Part 2 surveys a range of contemporary issues in technology and ethics that are relevant to education and learning. For example, the course considers issues of surveillance, engagement and addiction, and debates over profit-seeking. Part 3 focuses on drawing conclusions for practice, with application to individual students' professional contexts.

LDT 867: Designing and Researching Games and Online Communities for Teaching and Learning

3 Credits

This course focuses on historic and contemporary issues relevant to designing and researching games (digital and non-digital), and related media and online communities for learning. The purpose of the course is to provide an overview of relevant literature and timely topics related to games, learning and communities of practice in order to engage in effective research and design for learning and engagement. Drawing on interdisciplinary research, students will examine the history of digital games, research on game play and players, review how researchers from different disciplines have conceptualized and investigated learning through playing and designing games, and what we know about possible outcomes. The course also addresses how games and communities can effectively be designed to be inclusive of learners of different ages, backgrounds and abilities.

LDT 894: CAPSTONE EXPERIENCE

1-9 Credits/Maximum of 999

Supervised, professionally oriented student activities that constitute the culminating experience for the program.

LDT 895: Internship

1-18 Credits/Maximum of 18

Supervised, professionally oriented, off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

LDT 896: Individual Studies

1-9 Credits/Maximum of 999

Creative projects with a professional orientation, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses. Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

LDT 897: Special Topics

1-9 Credits/Maximum of 12

Forma courses given on a topical or special interest subject with a professional orientation that may be offered infrequently.

Liberal Arts (LA)

LA 802: Fundraising Leadership II: Achieving Success

3 Credits

This course focuses on advanced topics in fundraising and leadership: strategic planning, communications, and management of campaigns, events, and people.

LA 895: Internship

1-18 Credits/Maximum of 18

Supervised off-campus, non-group instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

Linguistics (LING)

LING 500: Syntax II

3 Credits

Advanced topics in syntactic analysis and theory. LING 500 Syntax II (3) The aim of this course is to provide students with the skills necessary to contribute to our understanding of modern generative syntactic theory (although other theories may be introduced by professors from different theoretical backgrounds). An overview of the theory of early generative grammar and its attendant problems will be presented in this course. Attempts to resolve these issues in contemporary syntax via the minimalist program will be covered in as much depth as possible. Using the skills and arguments developed in this course, students will be required to do original research on a particular problem of syntax.

LING 502: Historical Linguistics

3 Credits

Principles of comparative linguistics; language families; reconstruction of lost languages. LING 502 Historical Linguistics (3) The goal of this course is to engage graduate students in an analysis of the competing theories of the methods for classifying the world's languages. The course will provide an historical overview of the field with a major emphasis on contemporary debates. At issue will be whether all languages can be reconstructed to a common source. Is there possible evidence for such a reconstruction? Can the methodology faithfully extend to the very remote past?

LING 504: Phonology II

3 Credits

Advanced topics in phonological analysis and theory. LING 504 Phonology II (3) Students in this course will examine the shift from rule-based to constraint-based theories of phonology with an emphasis on analyzing the shortcomings and paradoxes inherent in earlier approaches. At issue will be the search for a better understanding of how the phonological component continually interacts with phonetics and morphology in order to create optimal outputs. Students will analyze particular problems through reading various journal articles treating the same topic from different approaches. They will then evaluate the various approaches systematically. The goal of this course is to prepare students to do close readings of advanced research.

LING 512: Linguistics and Language Science

3 Credits

This course is designed to familiarize students interested in linguistic diversity and human-machine interaction with fundamental theories and approaches in linguistics and language science. This course presents key topics in linguistics, with emphasis on research techniques and interfaces with other scientific disciplines (e.g. engineering, information technology, computer science). The primary focus is on linguistic diversity across the life span, including within-language regional and social variation, bilingualism, and language disorders. The course targets practical applications such as natural language processing, machine learning, automatic speech recognition, speech synthesis, voice identification, corpus analysis, and machine translation.

LING 519: Current Statistical Practice in Language Science

3 Credits

Our primary goal in this course is to explore how to analyze and interpret quantitative data in language science. Part of this goal will be to gain familiarity and proficiency with a range of quantitative techniques common in language science. Reflecting trends in the field, linear and logistic mixed effects regression will be a major focus in addition to more well-known (e.g. ANOVA, multiple regression, chi-square) techniques. We will also spend some time exploring other methods such as multidimensional scaling, generalized additive modeling, and conditional inference trees, as well as more specialized techniques (e.g. drift-diffusion modeling). A more important goal is to learn to think critically about quantitative data and how we can learn from it. This includes a critical view of quantitative research in general, questions of measurement, the many decisions involved in analytic strategy, model structure and interpretation, and the ability to extend students' knowledge to new techniques independently.

RECOMMENDED PREPARATION: Completion of an introductory graduate level course in statistics, or advanced undergraduate courses. Experience with regression and familiarity with common software for statistical analysis in language science.

Cross-listed with: SPAN 519

LING 520: Seminar in Psycholinguistics

3-9 Credits/Maximum of 9

Consideration of theoretical and research issues relevant to psychological aspects of language sounds, syntax and semantics, and other cognitive support. LING (PSY) 520 Seminar in Psycholinguistics

(3 per semester/maximum of 9) In this seminar, psycholinguistic approaches to bilingualism will be examined. Bilingualism is of interest for a number of reasons. First, despite the prevalence of monolinguals in the United States, most people of the world are bilingual. To have a genuinely universal account of human cognition will therefore require a detailed understanding of the relations between language and thought in individuals who speak and understand more than one language. It will be essential that research on basic cognitive functions in bilinguals examines both the course and the consequence of second language acquisition. Second, bilingualism provides a unique vantage point from which the relations between thought and language may be viewed. Historically, this issue was the focus of the debate over the Whorfian hypothesis (i.e., does language determine thought?). In contemporary psychology, it has emerged as a central issue in the debate over modularity. Understanding the form of language and memory representation in the bilingual may provide an important set of constraints in modeling the fundamental categories of the mind. Finally, bilingualism can provide a research tool for examining cognitive functions that are sometimes impenetrable within an individual's first language. The examination of the mapping of form to meaning in constructing syntactically well-formed sentences in two languages with contrasting syntax, or in understanding the meaning of words that have similar form but differ in meaning in two languages, provides a tool for developing converging sources of evidence to test theories of language comprehension and memory. Topics to be covered include second language acquisition in children and adults, language comprehension and memory in second language, code switching and language mixing, the consequences of bilingualism, and the neuropsychology of bilingualism.

Cross-listed with: PSY 520

LING 525: Experimental Research Methods in Psycholinguistics

3 Credits

This course provides an overview of experimental research techniques used in language science.

LING 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

LING 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

LING 823: Proseminar in Professional Issues in Language and Human Technology

3 Credits

This 3 credit course is designed to prepare students from disciplines in the language sciences and technological sciences for careers founded on principles of transdisciplinary research and collaboration. Application of these principles focuses on the integration of linguistic diversity in the design of human-centered technology. The course takes a holistic approach, recognizing that personal and professional development are intertwined. Students will engage with multimedia sources as well

as more traditional academic writings. Guest speakers from within and outside Penn State will provide students with varied perspectives and expertise. Upon successful completion of this course, students will be able to create a plan for engagement in transdisciplinary team science; compare career paths in different academic and non-academic institutions; describe steps in preparation for the job search process and create materials; compose science communication for a variety of audiences; plan how to benefit from mentoring and how to be a good mentor; evaluate professional ethics in a broad range of settings; apply principles of intellectual property and entrepreneurship to a business proposal; discuss how to maintain mental health, manage stress, and maintain work-life balance; and interpret and apply principles of diversity, equity, inclusion, and accessibility with an emphasis on linguistic diversity.

Management (MGMT)

MGMT 501: Behavioral Science in Business

3 Credits

Application of behavioral science concepts and analytical methods to problems in business organizations. Analysis of administrative behavior and decision making.

MGMT 520: Team Facilitation

2 Credits

To gain an in-depth understanding of team dynamics and develop skills for facilitating teams to achieve effective performance.

MGMT 528: Seminar in Organizational Behavior

3 Credits

Current theoretical and research issues applicable to the study of individual and group behavior within organizational settings.

MGMT 535: The Upper Echelons Perspective: Theory and Research

3 Credits

To learn to evaluate and conduct research on top executives and their influence on organizational strategy, structure and performance.

Prerequisite: admission to a doctoral program at PSU

MGMT 538: Seminar in Organization Theory

3 Credits

Current theoretical and research issues applicable to the study of design and management of complex organizations.

MGMT 539: Seminar in Organizational Social Networks

3 Credits

Learn theory, concepts and methods for research on organizational social networks. MGMT 539 Seminar in Organizational Social Networks (3) This course familiarizes doctoral students with the theory, research and methodological issues connected with social network analysis in organizational contexts. The course encompasses topics from the micro level (e.g., cognition and networks) to the macro level (e.g., interorganizational networks) and introduces a range of network ideas concerned with centrality, structural holes, embeddedness, and social

capital. Class periods will consist mainly of focused discussion of academic papers, but will also include discussion of data analysis exercises, and student presentations. Upon completion of the course, students should have a good grasp of social network concepts and methods and be able to use them to conduct research. The course requirements include participation in discussion, the completion of data analysis exercises, and the writing of a research paper. The course is designed for 15 students and is likely to be offered once every two years.

Prerequisite: admission to a doctoral program at PSU

MGMT 548: Seminar in Management

3 Credits

Current theoretical and research issues applicable to the study of Management, ranging from individuals embedded in organizations to organizational design, and strategy formulation / implementation. Students will learn about important theories and cutting-edge research across the management domain, with a particular focus on emerging research streams, particularly in the applied domain.

MGMT 551: Growth and Innovation Strategy

2 Credits

Identify opportunities for growth and profitability through technological and organizational innovations and market independently or with strategic partners.

Prerequisite: B A 571

MGMT 565: Power and Influence

2-3 Credits

Power and influence are ever-present and necessary features of organizational life; they are required to get things get done within organizations. Effective leadership therefore depends upon both understanding and possessing power and being influential. This course provides a pragmatic and ethical framework, based upon social science theory and evidence, for systematically analyzing the organizational and individual sources of power and influence, and the circumstances that lead to their attainment and effective use. The concepts and principles covered in the course provide the foundation for the skills needed to diagnose power situations, to manage conflict, and to use political strategies in responsible and pragmatic ways to get things done in organizational settings.

MGMT 578: Seminar in Corporate Strategy

3 Credits

Current theoretical and research issues applicable to the study of corporate strategy formulation and implementation.

MGMT 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

MGMT 591: Organizational Research Design

3 Credits

Experience in designing research for organizational science, to maximize the validity of eventual conclusions; methodological choices, constraints, and compromises (tradeoffs).

Prerequisite: admission to a doctoral program at Penn State; graduate-level statistics (linear model) course (e.g., STAT 501: Applied Regression Analysis).

MGMT 592: Qualitative Research Methods

3 Credits

This course provides students with an introduction to and experience with qualitative research methods employed in organizational contexts.

Prerequisite: admission to a doctoral program at Penn State

MGMT 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

MGMT 597: Special Topics

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

MGMT 597A: **SPECIAL TOPICS**

9.00 Credits

MGMT 599: Foreign Study--Management

1-12 Credits/Maximum of 12

Full-time graduate-level foreign study at an overseas institution with whom linkages have been established.

Prerequisite: acceptance in established exchange program International Cultures (IL)

MGMT 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

MGMT 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

NO DESCRIPTION.

MGMT 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

MGMT 807: Positive Organizational Behavior and Wellbeing

3 Credits

Exploration of positive organizational behavior and wellbeing concepts for developing the "human sustainability" factor in organizations.

MGMT 811: Sustainability Strategy Development

3 Credits

MGMT 811 Sustainability Strategy Development covers intermediate to advanced content for integrating sustainability into core business by identifying and managing the environmental and social impacts of a business in order to drive profitability, reduce risk, and for long-term value creation. This course provides students with knowledge, concepts, and practical tools for developing a strategic sustainability strategy and measuring financial, environmental, and social returns. Course content focuses on: (1) an exploration of "sustainability" and what it means to business regarding changes to the regulatory, consumer, competitive landscape; (2) analysis of international differences across Europe, Asia, Africa, the Americas and beyond; (3) strategy development including external and internal analysis, employee engagement, governance, and ensuring sustainability is "built in, not bolted on"; and (4) the latest business models and sustainable design solutions to drive business value and environmental/social performance.

MGMT 821: Complex Negotiations

1-3 Credits/Maximum of 3

The purpose of this course is to understand the theory and practice of negotiation in a variety of settings, with specific emphasis on multiparty contexts. A basic premise of the course is that while a manager needs analytical skills to discover optimal solutions to problems, a broad array of negotiation skills and an understanding of multiparty dynamics are needed in order for these solutions to be accepted and implemented. The course will allow students to develop these skills experientially and to understand negotiation in useful analytical frameworks. This course will give students an overview of the unique challenges and intricacies associated with multiparty negotiation, providing an opportunity to understand and develop applied skills regarding (a) the formulation of strategy and tactics before, during, and after a negotiation, and (b) third-party intervention in multiparty negotiation. Students will learn the structural and social characteristics of multiparty negotiation and develop techniques for managing its complexity.

Prerequisite: BA 805**MGMT 823: Organizational Change: Theory and Practice**

3 Credits

The primary purpose of MGMT 823 is to provide students with an overview of current theory and practice in organizational change and development. The primary aim of organizational development is to enhance organizational performance by improving the fit between individuals and the organization, as well as between the organization and its environment, all amidst ever-changing surroundings. This course will discuss current theories, models, research, techniques, and approaches to organizational change as well as the implications of change for organizational transformation and reconceptualization of management philosophies, principles, practices, and behavior that leads to high performance. The application of management and leadership skills

required to manage change are of primary interest in contemporary organizations and is the main focus of this course.

MGMT 831: Strategy Implementation and Organizational Change

2-3 Credits

This course addresses the managerial challenge of strategy implementation, particularly by examining the organizational elements that must be drawn into line to support a strategy, as well as the immense difficulties of changing an organization. As such, the course relies on two overarching frameworks. The first is a model of organizational alignment; the second is a model for managing the change process. The course will emphasize application and practice, primarily by the use of cases. Students will be asked, class after class, to take the position of a senior manager or an adviser to a manager, and develop answers to questions like these: What's the real problem here? How are the elements of the problem interconnected? What should be done? How, specifically, should we go about it? Strategy Implementation and Organizational Change will be relevant for a broad array of students, including those hoping to be managers, consultants, investors, and entrepreneurs. Because the course focuses on changing entire organizations (rather than small parts of organizations), we will be primarily taking the point of view of senior managers. However, our frameworks and tools, and the skills students will develop, will be useful early in their careers, as they face the need to manage change in their own subunits, as well as the need to comprehend and contribute to firm-wide changes.

MGMT 833: Career Innovation and the Future of Work

3 Credits

MGMT 833 explores emerging trends in technology, organizations, and society that create new workplace practices, job tasks, and required skills. This course begins by covering the past, present, and emerging forces that shape labor markets and career trajectories. Students will then gain insight into how new technologies, social norms, and business models play out in establishing new organizational shapes and employment arrangements. Analysis of macrolevel factors including globalization, demographics, and sustainability from the top down will be combined with a bottom-up examination of each student's traits, skills, priorities, and employment history and aspirations. Students will analyze their future labor as an entrepreneur would, examining new product development, opportunities, market analyses, and pricing options, and concluding with a go-to-market path.

MGMT 834: Leadership and Change in Organizations

1-3 Credits

This course mixes concept with practical, workable knowledge. We will focus on how students think about leadership, how things get done, and how things might be improved in organizations. This is the course that will allow students to discover, consider, and alter leadership tendencies and values. Self management is the major emphasis. Another is learning to lead organizations and the people in them humanely. It is also a course that will allow students to see the differing viewpoints and perspectives of peers concerning many leadership and organizational issues.

MGMT 841: Human Resource Management

3 Credits

Human Resources Management (HRM) includes evaluating the internal and external environments of an organization, assessing work and work outcomes, and acquiring, training, developing, and compensating employees. In addition, HRM includes labor-management relations, human resource information systems, and international HRM. All managers are responsible for HR practices and managing the employment relationship in organizations, and for the impact of their HRM activities. The primary objective of this course is to investigate how managers might identify, engage in, and evaluate effective Human Resources practices. In addition, the roles and practices of the HR professional are examined.

MGMT 845: Leading Diverse Organizations

1-3 Credits

Managing diversity and differences effectively is one of the most pressing leadership challenges in organizations today. This course focuses on increasing knowledge, skill, and confidence to address diversity related challenges that are an inevitable part of the manager's life. Course materials are organized around an Awareness-Empathy-Action/Allyship (AEA) framework. First, students will gain awareness around topics such as bias, prejudice, (in)equity and discrimination in the workplace. Course materials will direct students towards a greater awareness about how their personal biases and values shape decision making in interpersonal and group contexts as well as recognizing sources of bias and discrimination in the context surrounding them. Second, students will learn concepts that allow them to build empathy and take the perspective of others who are different. Often, people can empathize with others who share a similar background or set of values, but transferring this empathy across differences can be challenging. Through case discussions and experiential learning students will have an opportunity to build their empathy across differences. Both awareness and empathy contribute to the third key component of this course- taking action to ensure equity and inclusion in the workplace. Through cases and exercises students will learn when and how to take individual action as well as promote inclusive and equitable practices in organizations. Overall, the AEA framework provides a pragmatic and evidencebased approach to recognizing and addressing bias and discrimination as well as fostering an inclusive workplace culture.

MGMT 861: Global Strategy and Organization

2 Credits

This course focuses on the "strategic" challenges facing the multinational firm. The types of questions that we address are: Why do firms go abroad? What differentiates a "global" from a "multi-domestic" industry? What are the sources of competitive advantage in a global context? Why and when do/should companies engage in cross-border strategic alliances? What are the associated risks and how to guard against them? What potential roles can foreign subsidiaries play in an MNC's global strategy? How do companies choose an optimal global structure? How do companies ensure coordination between the center and the subsidiaries and among subsidiaries? How do companies manage strategic change from one type of global strategy to another?

Prerequisite: second year of MBA Program or graduate status in another program

MGMT 870: Entrepreneurial Finance

2 Credits

MGMT 870 provides a unique exposure to the field of financing start-up companies. The course combines a comprehensive overview of the various ways to finance a company along with an opportunity for students to evaluate start-up companies for investment consideration of up to \$100,000 utilizing the Garber Venture Capital Fund. Students learn which sources of funding are most suitable for the stage of the company and its business model based on the interests of those funding sources. These funding sources include friends & family, crowd funding, government funding, angel investors, venture capital, and debt financing. In addition, students learn key differences in financial terms unique to start-up company investments and develop valuation models. In parallel to the review of course materials, students work in teams to evaluate companies considered for a Garber Fund investment and present investment recommendations to their classmates and vote to invest in up to three companies.

Prerequisite: BA 831

MGMT 871: Strategic Management

3 Credits

This capstone course for the M.B.A. is meant to broaden the students' orientation, giving them the perspective of top management. This is accomplished by integrating information from many functional areas such as marketing, accounting, finance, and management, and providing a "big picture" strategic approach to the business environment. The course is meant to be a "value added" experience, and not just a review of what has been learned in the program to date.

Prerequisite: MGMT 501, ACCTG 811, BUSAD 523, MBADM 820, BA 800, BA 810
Recommended Preparations: Student must complete a minimum of 27 credits, including Foundation courses.

MGMT 873: Corporate Innovation Strategies

3 Credits

The goal of this course is to enable students to improve their understanding of managing and leading in changing environments. Students will study approaches to change, including resistance, learning, innovation, resilience, sustainability, and adaptation.

Prerequisite: MGMT 501

MGMT 880: Business Transformation Consulting

1-3 Credits

This course provides an understanding of key issues, concepts, and methodologies associated with business transformation and management consulting. It introduces students to the professional services industry, industry best practices, and a variety of client contexts where advisory services are needed. Additionally, students will learn common consulting methods and how to apply them in client organizations. A consulting-oriented solution development lifecycle is used as the organizing framework of the course. The primary phases of this framework include: client qualification/validation, problem identification, data gathering, requirements definition, project planning, solution design, solution development, solution implementation, and client relationship management. Students will learn to how to identify and define organization problems, highlight pain points, map

work flows, explore business models, investigate strategic alignment, develop recommendations, present business cases, and prototype solutions. The course will also enable students to learn how to advise clients and present key points and recommendations in a direct, clear, and compelling manner. The course objective is to provide students with consultative methods, skills, and tools essential to facilitating organizational change. It is designed around real-world problems and projects involving organizational assessment, solution development, and implementation planning. Students will be assigned to a consulting team. Each consulting team will be assigned to work with a corporate client to address a real-world business problem. Students will learn how to work proactively with key stakeholders to identify and understand the choices, risks, and benefits of particular solution alternatives, prepare project proposals, develop a plan to support the needed changes, and assess the effectiveness of business transformation efforts. Depending on the project, the recommended solution may be prototyped or fully developed during the course.

MGMT 883: Project Management & Delivery

1-3 Credits

MGMT 883 addresses concepts and methodologies associated with project management and the delivery of non-repetitive business activities. In this course, students will learn how to organize and manage work activities related to delivery of a collaborative venture that has unique objectives along with a beginning and an end. Along with the acquisition of fundamental project management knowledge and learning how to apply common project management tools/techniques, students will explore how to apply project management practices in multiple industries and contexts (i.e., consulting, internal corporate, multi-party, venture start-up). More specifically, students will learn and apply common project management tools and techniques used in various aspects of project management including but not limited to requirements gathering, stakeholder analysis, project definition/charter, project scheduling, project communication planning, risk mitigation planning, project budgeting & control, project metrics/assessment, project documentation planning, and project closeout assessment. Traditional and agile approaches to project management will be explored along with the benefits and drawbacks of each approach. Strategic considerations will include identification of success criteria, effective use of KPIs and performance metrics, timely identification and mitigation of project risk, team formation, resource constraints, project sponsorship, leadership within a project management context, and management of scope creep.

MGMT 885: Management Consulting Methods and Practice

1-3 Credits

MGMT 885 explores the methods and tools commonly used in the practice of management consulting. This course is intended for students interested in working in this field or working in organizations that hire management consultants. It is organized into the following topical areas: Management Consulting as a Discipline ζ In this area, students learn how management consulting fits into the overall business marketplace and why/how firms engage management consultants as a resource. Tools, Methods, and Practices for Managing the Engagement ζ In this area, students learn methods and practices commonly used to manage a project/engagement in a management consulting context. This area covers topics related to understanding the overall life cycle of a consulting engagement, as well as tools and techniques used to manage scope, time, people, finances, risks, and overall activity on a consulting project. Tools, Methods, and Practices for Research

and Information Gathering ζ In this area, students explore tools and techniques used by management consultants to conduct both secondary and primary research as means for investigation and learning. Tools, Methods, and Practices for Analysis and Solution Generation ζ In this area, students learn tools, frameworks, and methodologies commonly used by management consultants to assess a client's needs, to analyze information, to generate potential solutions, and to evaluate potential solutions in a given context. Tools, Methods, and Practices for Change Management ζ In this area, students learn theories, models, and frameworks related to overcoming barriers to change and to implementing change within a business organization. Tools, Methods, and Practices for Client Communication ζ In this area, students learn tools and techniques used by management consultants to communicate with their client in order to effectively manage an engagement, to influence stakeholders, and to enhance impact of their work.

Management - BC (MANGT)

MANGT 510: Project Management

3 Credits

A problem-based, interdisciplinary course in project management skills and techniques needed to manage projects in a modern business environment. MANGT 510 Project Management (3) Project Management has been labeled by Fortune magazine as the number one career choice for the coming decade. Increasingly, organizations are adopting project management techniques and structures within their business framework. Project management offers the twin advantages of allowing organizations to create products and processes efficiently, through optimal use of resources, and rapidly, to respond to rapid time-to-market demands. This course would give business majors a competitive advantage in the job market, as companies are in great need of a trained cadre of qualified project managers who can allow the business firm to operate to its highest potential. The role of the instructor in this course is to train students in the wide variety of demands and skills for which they must be qualified: the ability to exert leadership in managing project teams, an understanding of people and behavioral skills, and the ability to effectively use computer-based scheduling and tracking software to keep to timetables and schedules. The course itself would be set up around semester-long projects, either developed by the instructor, or developed (in collaboration with the instructor) by students involved in business enterprises. As a result, students would have real-time experience in the challenges of creating a unified team, solving problems, tracking their projects, and presenting a final paper and presentation on the process.

Prerequisite: graduate standing

MANGT 515: Cost and Value Management

3 Credits

A problem-based course that emphasizes project cost control and teaches students to apply techniques to control projects in business. MANGT 515 Cost and Value Management (3) Project management has been labeled by Fortune magazine as the number one career choice for the coming decade. Increasingly, organizations are adopting project management techniques and structures within their business framework. Project management offers the twin advantages of allowing organizations to create products and processes efficiently, through optimal use of resources, and rapidly, in order to respond to rapid time-to-market demands. At the same time, however, substantial interest has been generated in the methods for effective cost control in the

project environment. How can an organization implement projects while maintaining control of its costs and value? The role of the instructor in this course is to promote student learning of a wide variety of knowledge and skills required for successful project management. These include the ability to understand "cost" and "value" as these terms apply to project management, to understand the nature of budgeting and financial analysis for project selection and control, and the ability to interpret control information as it allows for change (configuration) management of mid-stream projects.

Prerequisite: or concurrent: MANGT510

MANGT 520: Planning and Resource Management

3 Credits

A problem-based course that addresses techniques for planning the project development process, including securing resources and resource management. MANGT 520 Planning and Resource Management (3) Project management has been labeled by Fortune magazine the number one career choice for the coming decade. Increasingly, organizations are adopting project management techniques and structures within their business framework. Project management offers the twin advantages of allowing organizations to create products and processes efficiently, through optimal use of resources, and rapidly, in order to respond to rapid time-to-market demands. The key "front-end" processes associated with successful project management consist of planning and resource management—in effect, the need to first plan the work, ensure necessary resources are available, and thoroughly understand the components of the project plan, including activities and their interrelationships. The role of the instructor in this course is to promote student learning of a wide variety of knowledge and skills required for successful project management. These include the ability to understand planning and resources as these terms apply to project management, to understand the nature of developing comprehensive plans and schedules, manage resources for their maximum effect, and learn how to respond to crises or unanticipated events in terms of adjustments to plans and resource requirements.

Prerequisite: or concurrent: MANGT510

MANGT 525: Commercial Law and Project Procurement

3 Credits

A problem-based course that addresses elements of commercial law and procurement practices and their implications for project management. MANGT 525 Commercial and Procurement (3) Project management has been labeled by Fortune magazine as the number one career choice for the coming decade. Increasingly, organizations are adopting project management techniques and structures within their business framework. Project management offers the twin advantages of allowing organizations to create products and processes efficiently, through optimal use of resources, and rapidly, in order to respond to rapid time-to-market demands. This course looks at the key issues in contracts, contract law, negotiation, and procurement. In developing projects for external clients, it is vital that organizations and project team members understand some of the basics by which contracts are negotiated and enforced. The role of the instructor in this course is to promote student learning of a wide variety of knowledge and skills required for successful project management. These include the nature of contracts and contract law, the use of contracts as a procurement strategy, how to understand the nature of contracts, their use as a negotiation tool, and the use of

bidding and negotiation in relationships between project organizations and their customer base.

Prerequisite: prerequisite or concurrent: MANGT510

MANGT 531: Organizations

3 Credits

An examination of organizational theories and processes of organizational behavior.

MANGT 535: Interpersonal and Group Behavior

3 Credits

A human relations-based course that identifies the significant challenges that managing individuals on project teams represents. MANGT 535 Interpersonal and Group Behavior (3) Project management has been labeled by Fortune magazine as the number one career choice for the coming decade. Increasingly, organizations are adopting project management techniques and structures within their business framework. Project management offers the twin advantages of allowing organizations to create products and processes efficiently, through optimal use of resources, and rapidly, in order to respond to rapid time-to-market demands. This course serves as an important linkage between the technical demands of project management and the behavioral challenges that await project teams in the form of interpersonal behavior and group interactions. The role of the instructor in this course is to promote student learning of a wide variety of behavioral knowledge and skills required for successful project management. These include understanding the impact of interpersonal behavior and team-based performance on project success as well as recognizing the impact of issues such as motivation and negotiation skills for managing projects.

Prerequisite: prerequisite or concurrent: MANGT510

MANGT 540: Strategy: Corporate, Business and Project

3 Credits

A problem-based course that focuses on linking projects to overall corporate strategy. MANGT 540 Strategy: Corporate, Business and Project (3) Project management has been labeled by Fortune magazine as the number one career choice for the coming decade. Increasingly, organizations are adopting project management techniques and structures within their business framework. Project management offers the twin advantages of allowing organizations to create products and processes efficiently, through optimal use of resources, and rapidly, in order to respond to rapid time-to-market demands. This course provides a conceptual grounding in the role that projects play in furthering an organization's strategic goals. Projects are, in effect, the building blocks of strategy because they represent the operationalization of strategic plans. The role of the instructor in this course is to promote student learning of a wide variety of knowledge and skills required for successful project management. These include understanding the complex, widely diverse nature of the skills and knowledge required of modern project managers.

Prerequisite: prerequisite or concurrent: MANGT510

MANGT 545: Project Team Leadership

3 Credits

This course focuses on development of team leadership skills and the ability to solve team problems related to human interaction. MANGT 545 Project Team Leadership (3) The first half of this course consists of self-paced assigned readings which cover basic concepts of team leadership. Students will complete quizzes over each chapter which they read and begin writing a personal case analysis. The second half of the course utilizes case studies of project teams and includes extensive class and small group discussions. In addition, each student will present a case analysis to the class. Students will have the opportunity to develop basic team leadership skills and the ability to solve team problems as they arise.

Prerequisite: MANGT510 and MANGT535**MANGT 575: Management of Projects**

3 Credits

A problem-based capstone course that integrates the themes necessary to appreciate the overall challenge of project management. MANGT 575 Management of Projects (3) Project management has been labeled by Fortune magazine as the number one career choice for the coming decade. Increasingly, organizations are adopting project management techniques and structures within their business framework. Project management offers the twin advantages of allowing organizations to create products and processes efficiently, through optimal use of resources, and rapidly, in order to respond to rapid time-to-market demands. This course serves as a capstone experience intended to require students to be able to integrate the various elements from the previous set of project management courses they have covered. The course requires all other courses as prerequisites or co-requisites so that students may be sufficiently knowledgeable to synthesize all prior material. The role of the instructor in this course is to promote student learning of a wide variety of knowledge and skills required for successful project management. These include understanding the complex, widely diverse nature of the skills and knowledge required of modern project managers. In order to cover sufficiently the capstone material, students must have a thorough background in the various issues that comprise this capstone experience.

Prerequisite: MANGT510 prerequisite or concurrent: completion of at least 15 credits from MANGT 515, 520, 525, 531, 535, or 540.**MANGT 596: Individual Studies**

1-9 Credits/Maximum of 9

CREATIVE PROJECTS, INCLUDING NONTHESIS RESEARCH, WHICH ARE SUPERVISED ON AN INDIVIDUAL BASIS AND WHICH FALL OUTSIDE THE SCOPE OF FORMAL COURSES.

MANGT 597: Special Topics

1-9 Credits/Maximum of 9

FORMAL COURSES GIVEN ON A TOPICAL OR SPECIAL INTEREST SUBJECT WHICH MAY BE OFFERED INFREQUENTLY; SEVERAL DIFFERENT TOPICS MAY BE TAUGHT IN ONE YEAR OR SEMESTER.

MANGT 850: Project Risk Analytics

3 Credits

A problem-based course that emphasizes project risk assessment, prioritization, and risk-driven planning. This course teaches students pragmatic perspectives on uncertainty and project risk and how to use analytic tools to create actionable risk information for real-world decision-making in project planning, execution, and control. Risk management is an indispensable element for effective project management. The course introduces students to proven theories, analytic tools, and best practices in risk management to manage a project to its success in VUCA (volatile, uncertain, complex, and ambiguous) environments. In this course, students will learn that project risks are not necessarily surprises and can be effectively managed by using analytic tools and best practices in risk management planning, risk identification, qualitative and quantitative risk analyses, risk response planning, and risk monitoring and control. The course also emphasizes applications of risk concepts and analytic tools to state-of-the-art practices. Case studies will be used to help students develop a practical understanding of the best practices in project risk management.

Concurrent: MANGT 510 Recommended Preparation: This course requires basic knowledge of statistics and Microsoft Excel, including but not limited to mean, mode, median, variance,**MANGT 855: Project Management and Marketing Linkages: New Product and Service Development Process**

3 Credits

This is a graduate-level project management elective designed to expose project managers to strategic issues in marketing, opportunity recognition, and new product/service development. Marketing is presented as more than a business function; rather, as a philosophy of doing business. Students will be exposed to marketing management concepts and techniques in both domestic and international markets. This elective is intended to offer a specific context within which a large number of projects are initiated - i.e., new product and service development (NPSD) while broadening the perspective of students to understand how NPSD and project management directly link to marketing. An overview of the field of marketing is presented - from defining marketing and understanding its role in running a successful business to a thorough examination of the marketing mix, holistic marketing, marketing strategies, market opportunities analysis, branding, brand equity, and so on. It presents the marketer's view of product and service development as well as an understanding of stakeholder management and how project managers must work with marketing as a key stakeholder in the NPSD process. Further, the course explores linkages between marketing and project management - e.g., identifying opportunities, developing strategies, building a business case, identifying key performance indicators, and so forth. Identifying opportunities, developing strategies, and designing processes for the creation of new products, are key responsibilities for both entrepreneurs and managers in established firms. Developing new products and services is also fraught with risk, however: an overwhelming majority fail when introduced to the market. New product development is thus a joint challenge of marketing and effective project management. This course is about improving the odds of placing winning bets on new products and services. Strategies and processes for new product/service development will be the core of the course.

Prerequisite: MANGT 510

Management - CA (MNGMT)

MNGMT 505: Managing Human Resources

3 Credits

Issues in human resource management including recruitment and selection, employee development, performance management, employee and labor relations, and employee safety. MNGMT 505 Managing Human Resources (3) This course examines the primary functions and responsibilities of those who manage human resources in formal organizations. The emphasis of this course is on the practical application of the methods human resource specialists, generalists, and managers use to perform their duties. The course is designed to appeal not only to future (or current) human resource practitioners, but also to anyone who aspires to manage people in organizations. Topics covered include management practices, the legal and regulatory environment of human resources, employee recruiting, selection and placement, training and development, performance management, compensation and benefits, employee and labor relations, and employee health, safety, and security. This course surveys the major functions and responsibilities of human resource managers. In doing so, a primary objective is to gain greater factual knowledge of human resource issues by studying organizational practices, analyzing cases, conducting research using the World Wide Web, and utilizing other sources of information. It is also hoped that each student will develop a philosophy concerning the relationships among the employee, employer, union, and government agencies involved in employment issues. Students' knowledge is evaluated, in part, using written examinations. Each student is also typically the member of a small team that will research a specific challenge, trend, or issue that currently confronts human resource managers. Each team prepares a concise and focused presentation and written summary on its chosen topic. Other means of evaluating student knowledge may include case analyses, investigations of human resource practices within specific organizations, or other related projects.

Prerequisite: admission to graduate degree status

MNGMT 511: Organizational Behavior

3 Credits

Individual and group behavior in organizations' motivation, performance, rewards, satisfaction, decision processes, conflict; job and organizational design; structure and culture. The field of organizational behavior is intended to further our understanding of human behavior in work and organizational contexts. The field draws upon research emanating from any social science discipline (e.g., psychology, social psychology, sociology, anthropology, etc.) that might offer insight as to how individuals and groups function effectively within work contexts. The overall goal is 1) to explore how individuals' work experience can be made more satisfying and personally fulfilling to them, and 2) to explore how organizations can manage and shape human behavior in ways that optimize organizational effectiveness and organizational goal accomplishment. Particular emphasis is placed upon the study of individual and group-level dynamics within organizations, including topics such as motivation, individual differences, ethics, emotional intelligence, group dynamics, decision-making, stress, power and politics, leadership, and organizational culture and structure.

MNGMT 514: Organizational Innovation and New Venture Development

3 Credits

Advanced study of the process of innovation from an organizational perspective. Includes analyses of individual, organizational, and environmental variables. The subject of MNGMT 514 is the process of innovation in organizations and the factors associated with its successful implementation. Among the topics covered are the creative process as the wellspring of innovation and elements of organizational architecture (structure and culture) that influence the process of innovation. Entrepreneurial strategy is discussed as a means for creating competitive advantage through innovation. During the last third of the course, students will develop a new venture model for an innovation by applying the concepts developed in the first part of the course. New venture models will be developed using collaborative learning groups established at the beginning of the course.

Prerequisite: MNGMT511

MNGMT 515: Labor Management Relations

3 Credits

Labor relations issues; collective bargaining agreement, negotiations, and administration; legal framework of collective bargaining; labor relations in larger social context.

Prerequisite: admission to MBA/MSIS Program
Cross-listed with: PADM 515

MNGMT 520: Organizational Transformation

3 Credits

Treats methods, practices, and theory of organizational empowerment, quality management, process redesign, re-engineering, restructuring, and planned change. MNGMT 520 Organizational Transformation (3) The objective of this course is to review the current theory and practice of organizational development (OD), and applied field of social science. ODs primary aim is helping to improve the alignment between individuals and the organization, and between the organization and its environment in order to achieve greater effectiveness, performance, and stakeholder satisfaction. The course provides an overview of theories, research findings, approaches, and concepts of OD. Particular attention is paid to discussing practitioner-centered cases in OD. Large-scale, system-wide organizational development - usually one that involves a paradigm shift is often referred to as Organizational Transformation or Re-engineering. The paradigm shift often involves a re-conceptualization of management philosophies, principles, practices, and behavior leading to a high performing, empowering organization.

Prerequisite: MNGMT511

MNGMT 522: Operations and Supply Chain Management

3 Credits

Design, development, management of manufacturing systems in a supply chain context; tools, techniques, and applications at tactical and strategic levels. MNGMT 522 Operations and Supply Chain Management (3) The purpose of Operations and Supply Chain Management is to provide students with tools and knowledge that can help them increase productivity and profitability in a manufacturing environment. Both strategic and tactical aspects of operations management will be emphasized. The course is taught in supply chain context meaning that

decisions made in manufacturing must consider the overall impact of the suppliers and customers in the supply chain. Students will be asked to read and participate in the discussion of articles dealing with progressive operations and supply chain methods. The course also incorporates the case study method, in order to provide students an opportunity to apply their knowledge in class.

Prerequisite: BUS 505

MNGMT 523: Service Operations Management

3 Credits

Design, development, and management of service systems. Tools and techniques for non-manufacturing operations at tactical and strategic levels. MNGMT 523 Service Operations Management (3) This course is designed to introduce students to the operational aspect of a service organization, the kinds of decisions that operations managers make, and the impact these decisions have on the tactical and strategic position of the firm. Students will be introduced to tools and concepts that have the ultimate objective of increasing the productivity of the firm and the customer satisfaction of its clientele.

Prerequisite: BUS 505

MNGMT 570: Leadership Development

3 Credits

Experientially based skill-building for development of managerial and leadership competencies.

MNGMT 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

MNGMT 596: Individual studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

MNGMT 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

MNGMT 841: Entrepreneurial Funding Strategies

3 Credits

Entrepreneurial Funding Strategies is an in-depth analysis of concepts, strategies, and techniques to obtain funding for start-ups and entrepreneurs. This course covers an overview of entrepreneurship, techniques for analyzing cash needs, strategies for financing the new venture, building venture relationships, and exit strategies.

MNGMT 897: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

MNGMT 897A: **SPECIAL TOPICS**

3 Credits

Manufacturing Systems Engineering (MFGSE)

MFGSE 550: Design for Manufacturability I

3 Credits

Introduction to DFM, a review of enabling technologies and the systematic use of quality tools during the DFM process. MFGSE 550 Design for Manufacturability I (3) This course will provide the student with an introduction to the product design process and techniques used in the design process to optimize product design for both overall quality and minimum cost. PRODUCT DESIGN PROCESS Product fit, competitive analysis, bench marking (2 periods) Concurrent engineering (2 periods) Process standards (2 periods) Value engineering, cost containment methods (2 periods) Project management (3 periods) Product liability, patents, trade secrets (1 period) Design standards (e.g., UL, ASME) (1 period) Process standards (e.g., ISO 9000, Q.S. 9000) (1 period) The topics include: Design for Manufacturability, Design for Assembly Enabling Technologies for DFM and DFA, Quality Tools. Student performance will be evaluated by written reports, quizzes and exams.

Prerequisite: graduate standing

Marketing (MKTG)

MKTG 500: Marketing Management

3 Credits

Development of a marketing management focus, including market analysis, competition analysis, and decisions in pricing, product, promotion, and distribution channels.

Prerequisite: ACCTG511 or ACCTG512 ; B A 533

MKTG 518: Global Marketing

3 Credits

Role of international marketing in the global business environment; development of marketing plans and implementation strategies under differing socio-economic conditions.

Prerequisite: MKTG 500

MKTG 519: Data Collection for Business Research

3 Credits

Modern organizations rely on data to understand markets and customers. Data-driven business decision-making isn't a fad, it's a requirement for business success. MKTG 519 will prepare students to collect business data, including the methods, techniques and practices associated

with quantitative and qualitative studies. Students will learn how to align research with information needs, select the appropriate method of collection, design a sample and recruit participants, craft and administer questionnaires, and apply experiments to assessing business topics. Likewise, students will learn about various qualitative research techniques and the role a discussion guide plays in gathering this type of data. Data privacy and research ethics are also covered.

MKTG 521: Scientific Marketing Analysis and Implementation

2 Credits

An introduction to the tools used, rationale for, and the practice and implementation of a variety of current marketing techniques. MKTG (MS&IS) 521 Marketing Engineering (3) This course deals with concepts, methods, and applications of decision modeling to address such marketing issues as segmentation, targeting and positioning, new product design and development, advertising, sales force and promotion planning, and sales forecasting. The course is designed for MBAs as well as for students in engineering and related disciplines who have some background in or understanding of marketing principles, and exposure to spreadsheet programs such as EXCEL. Unlike conventional capstone marketing courses that focus on conceptual material, this course will attempt to provide skills to translate conceptual understanding into specific operational plans—a skill in increasing demand in organizations today. Using market simulations and related exercises tied to PC-based computer software, students will develop marketing plans in various decision contexts. Specifically, the course objectives are to: Provide students with an understanding of the role that analytical techniques and computer models can play in enhancing marketing decision making in modern enterprises. Improve students' skill in viewing marketing processes and relationships systematically and analytically. Expose students to numerous examples demonstrating the value of the analytic approach to marketing decision making. Provide students with the software tools that will enable them to apply the models and methods taught in the course to real marketing problems. The course will be of particularly valuable to students planning careers in marketing and management consulting. The course is designed for students with some background in quantitative methods as well as some exposure to basic marketing concepts. Class sessions will be devoted to probing, extending and applying the material in the readings and the cases. We will use the "Tell-Show-Do" sequence to give you hands-on experience in using the course materials for making marketing decisions. It is your responsibility to be prepared for each session as detailed in the course outline. Each one of you will benefit from belonging to a "study group" that meets and prepares for each session before coming to class.

Prerequisite: B A 500

MKTG 532: Brand Management

2 Credits

To examine and understand the processes of building, designing, measuring, and maintaining brand equity.

Prerequisite: B A 500

MKTG 534: Integrated Market Communications

2 Credits

Provides the frameworks for thinking, tools, language, and skills for strategic management of integrated market communications.

Prerequisite: B A 500

MKTG 540: Marketing Analytics

3 Credits

The course objectives are to demonstrate to students the benefits of using systematic and analytical approaches to marketing decision-making, and to build their skills and confidence in undertaking such analyses and decision-making in a modern enterprise. The analytical approaches covered in the course will enable students to identify alternative marketing options and actions that enhance business performance, predict the expected market and consumer reactions associated with potential marketing actions undertaken by a business, calibrate the opportunity costs associated with each action, and choose one or more actions that have the highest likelihood of achieving established business goals. The course will help students to develop skills that will enable them to propose and justify marketing expenditures using a Return on Investment (ROI) logic that businesses are increasingly asking of their executives. This course builds on the basic business analytics concepts and methods that business students are expected to have. The topics covered include a range of analytical concepts and tools associated with various aspects of marketing, including segmentation, targeting, positioning, product design, short-term and long-term forecasting, marketing resource allocation, search engine advertising planning, social influence measurement, A/B testing, and attribution analysis.

Prerequisite: MKTG 811

MKTG 541: Consumer Behavior

2 Credits

Introduce theories and concepts from psychology, sociology, economics, and other disciplines that are useful in understanding and marketing to consumers.

Prerequisite: B A 500

MKTG 543: e-Marketing

2 Credits

Using the Internet and related technologies to enhance and transform marketing functions and processes.

MKTG 551: Theoretical Perspectives on Buyer Behavior

3 Credits

Review of marketing and social sciences research related to understanding consumer and market behavior.

MKTG 554: Research Methods in Marketing

3 Credits

Philosophical, methodological, and measurement issues involved in designing, conducting, analyzing, and interpreting research in marketing.

MKTG 555: Marketing Models

3 Credits

Topics in the model building approach to marketing decision making, focusing on current research issues.

MKTG 556: Marketing Management

3 Credits

To explore the conceptual and applied dimensions of marketing management. MKTG 556 Marketing Management (3) This course is a seminar course, so class involvement will be a major component. In addition, students will be expected to prepare two papers. The first will be a journal submission review; the second will be the written version of each student's research proposal. Academics need to understand journal reviewing, and they need to develop research ideas and write about them. Students will also be expected to prepare and perform two oral presentations. The first will be the presentation discussed in the session description below and will be a part of their class participation. The second will be an oral form of the student's research presentation. Students need to be able to communicate their ideas, and it is hoped that having an oral presentation of their proposals before the written presentation will also help them improve their proposal. Finally, there will be an examination at the end of the course. Each class session, with the exception of the first and last class periods, will be devoted to an important topic in the marketing management domain. For each class period, other than the two exceptions, students will read around 7 papers. The papers will be a mix of classical, seminal works and recent, cutting-edge works in the assigned area. The bulk of the class period will be devoted to discussion of the articles assigned. Discussion will be devoted to a) why the article is important, b) good points of the article, c) bad points of the article, and d) research ideas that the article might suggest or engender. In addition, one student per week will be responsible to find, prepare, and present another published paper that deals with the weeks' issues; this presentation will be part of the student's participation grade. The last few minutes of each class will be devoted to a discussion by the instructors of where research in the assigned area is going and some interesting open research questions in the area. The two exceptions among the class periods will be the first and last class. In the first class, we will have an introduction to research in marketing management and this particular Ph.D. seminar, while the last class will be devoted to allowing the remaining students to present their research proposals.

Prerequisite: MKTG 551; Concurrent: MKTG 555

MKTG 571: Marketing Strategy

2 Credits

Examines business-level marketing issues and solutions to problems in competitive business environments.

Prerequisite: B A 500

MKTG 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

MKTG 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

MKTG 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

MKTG 599: Foreign Study--Marketing

1-12 Credits/Maximum of 12

Full-time graduate-level foreign study at an overseas institution with whom linkages have been established.

Prerequisite: acceptance in established exchange program
International Cultures (IL)

MKTG 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

MKTG 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

MKTG 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

No description available.

MKTG 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

MKTG 811: Driving Business Success with Marketing Analytics

3 Credits

Data-driven marketing is essential for today's business success. MKTG 811 prepares students with the fundamental skills to successfully leverage marketing data in business decision making and strategy. Students will learn how to map data to marketing challenges, apply basic statistics to marketing analyses, report results in meaningful ways, and support organizations in effectively leveraging marketing data. Special emphasis is given to translating data into meaningful and actionable

business insights. This course does not assume any prior knowledge in statistics.

MKTG 812: Evaluating Marketing Communications in the Digital World

3 Credits

This course provides students with the basic principles, procedures, and objectives of using analytics to assess digital marketing communications. Course content focuses on key areas of marketing communication evaluation, including audience engagement, messaging and content effectiveness, campaign reach and influence, marketing mix allocation, social sentiment and impact, and mobile and website user experience. Students will gain practical experience with a variety of analytic tools and software.

MKTG 813: Data-Driven Customer Acquisition & Retention

3 Credits

MKTG 813 focuses on leveraging marketing data to support acquiring, developing relationships with, and retaining customers. Through the lens of the Customer Lifecycle, students will learn key data analytic techniques for targeting the right customers, engaging them and moving them through the path to purchase, identifying customer profitability and customer lifetime value, managing challenges such as customer churn, and building and managing customer loyalty programs.

Prerequisite: MKTG 811

MKTG 814: Analytics for Brand Management and Customer Experience

3 Credits

MKTG 814 prepares students to apply marketing data analytics in support of brand and product success. The course familiarizes students with analytics for brand and product positioning, brand equity and loyalty, price optimization, and enhancing the customer experience. Special emphasis is placed on data visualization and communicating data insights in ways meaningful for strategic business application.

Prerequisite: MKTG 811

MKTG 815: Marketing Data Integration to Create Consumer Insights

3 Credits

This course provides students with an overview of current principles and practices in data visualization and reporting. Students will learn how to translate data results into actionable insights and communicate these findings in ways that facilitate attention, interest, understanding, and strategic application. Course topics include developing insights, data storytelling, presenting data visually, and designing effective data deliverables. This capstone course provides students with the opportunity to integrate skills learned throughout the Master's program. In a project spanning the semester, students will select data to address a specific marketing challenge, analyze the data and develop insights, and communicate the results in an engaging and strategic deliverable.

MKTG 816: Business-to-Business Marketing Analytics

3 Credits

This course is designed to provide students with an understanding of how to successfully leverage data and analytics to support Business-to-Business (B2B) marketing success. This course will cover key elements

of B2B marketing analytics, including collecting relevant data and using it to support customer segmentation, brand management, product development, customer experience, and pricing strategies.

MKTG 817: New Product Development and Management

3 Credits

This course focuses on the analytical, decision making, and planning concepts, frameworks, and tools available to market, product, and brand managers regarding innovation and new product development.

MKTG 818: Business-to-Business Marketing Strategy

3 Credits

This course is designed to provide students with a framework for value creation and delivery in business-to-business (B2B) markets. The course introduces basic concepts and theories of B2B marketing, includes application to various strategic B2B marketing decisions, and offers an overarching framework for B2B marketing strategy formation. The applied nature of the course is reflected in the focus on tools and frameworks, the use of case studies, cameos by B2B industry leaders, and assignments encouraging students to creatively approach and solve B2B marketing problems and make decisions that foster organic growth.

MKTG 833: Business Marketing

3 Credits

MKTG 833 focuses on transactions between organizations, i.e., "Business-to-Business" (B2B) markets, which are critical to the growth and health of the economy, and an essential part of economic life. In most years, the \$ volume of transactions between businesses exceeds transactions that are Business-to-Consumer (B2C). The bulk of online business is B2B. Yet, B2B markets differ fundamentally from B2C markets. In this class, students learn the language, concepts, theories, principles, and best practices of modern B2B marketing. The course follows a proven template for developing B2B marketing strategy to drive business results. This framework is called the Value Delivery Framework, and covers building a value understanding, strategy formulation, the design of customer value, the communication and delivery of customer value, and life-cycle management.

Prerequisite: BA 800

MKTG 842: New Product Development and Management

2 Credits

MKTG 842 focuses on the analytical, decision making, and planning concepts, frameworks, and tools available to market, product, and brand managers regarding innovation and new product development. The course covers strategic topics on innovation and new product development. In doing so, the course broadly tracks the new product development process including opportunity identification, idea generation methods (both within and crossing firm boundaries such as design thinking, open innovation, and crowdsourcing), concept evaluation and selection, product design, product use testing and prototyping, innovation adoption and diffusion, and sales forecasting. Topical issues such as technological developments relevant to innovation and new product development are covered as well. Students learn the fundamental concepts of innovation and new product development, how to apply tools and frameworks to business situations, such to formulate an appropriate approach to innovation and strategic new product needs, and

how to apply qualitative and quantitative techniques to conduct business analysis at various stages of the new product development process in a hands-on team new product development project. Through lectures, case discussions, and a variety of experiential learning methods, the course provides an in-depth understanding of real-world challenges in innovation and new product development.

Prerequisite: BA 800

Marketing - CA (MRKT)

MRKT 513: Marketing Management

3 Credits

Analysis of market opportunities, development of marketing strategies, implementation of marketing plans, and control of marketing processes. This course examines concepts, techniques, and developments of marketing plans and programs within domestic and international market environments. The major focus of the course will be on the analysis of market opportunities; development of marketing strategies, plans, and programs; organization of the marketing activities; implementation of the marketing plans, strategies, and programs; and control of the marketing processes. Furthermore, important contemporary issues of social responsibility, green marketing, and marketing ethics will be explored conceptually and analytically.

MRKT 514: Strategic Mrkt

3 Credits

Analysis and implementation of strategic marketing concepts and techniques in complex domestic and global business environments. The objective of this course is to provide students with a deeper understanding of marketing management in a strategy-planning context. The course is concerned with the development, evaluation, and implementation of marketing management in complex domestic and global business environments. The course deals primarily with an in-depth analysis of theories, facts, analytical procedures, techniques, and models related to marketing institutions and processes.

Prerequisite: MRKT 513

MRKT 571: Consumer Behavior

3 Credits

Factors influencing buyer behavior; contributions of the behavioral sciences to the study of selected phenomena. MRKT 571 Consumer Behavior (3) This course is intended to introduce graduate students to the basic theoretical ideas and techniques of investigations into consumer behavior phenomenon. Such a study will, it is hoped, provide an appreciation of the problems of consumer behavior and the techniques available for their solution. Specific objectives are: (a) The prepared graduate students who will enter a wide range of careers with a substantial knowledge of consumer behavior theory, research, and state-of-the-art conclusions, that will permit them to use more sophisticated analytical techniques in anticipating and meeting consumer needs and demand. (b) To offer strategic how-to, and "insider" information for using theoretical concepts and techniques and give graduate students specific opportunities, within the course.

Prerequisite: MRKT 513

MRKT 572: Marketing Research

3 Credits

Management information needs, evaluation of research proposals and findings, methods of data collection and analysis, integration of research and decisions. MRKT 572 Marketing Research (3) This is a graduate level Marketing Research course and deals with collection, processing, analysis and interpretation of information, which are main steps in completing a successful market research project. The course provides students with an understanding of marketing research and its is designed in the belief that one must understand market research jobs and use it effectively in managerial decision-making. It is practical oriented and aligned with scientific, scholarly and logical truth. The course will cover the research process including problem identification, secondary and primary data collection questionnaire design, sampling, coding process, research methodology, data analysis and interpretations, and communication with management through research reports and presentations.

Prerequisite: MRKT 513

MRKT 585: Business-to-Business Marketing

3 Credits

Marketing of products and services to other businesses and organizations including strategy, planning, research, communications, pricing, distribution, and global issues. MRKT 585 Business-to-Business Marketing (3) This course builds upon marketing management concepts and focuses on the special elements and requirements of business-to-business marketing. Emphasis is given to managerial decision-making in the areas of business marketing environment, business buying functions, business marketing strategy, business marketing systems, business marketing planning, business marketing research, business marketing segmentation and demand analysis, product strategy in business marketing, business marketing communications, promotion, pricing, and distribution and globalization strategy in business marketing. The course employs real marketing situations treated analytically and emphasizing business marketing situations. In order to present the materials in a real life environment, case problems from business-to-business marketing will be used. Heavy student preparations and participation are expected. The course will also cover business marketing strategies on the Internet.

Prerequisite: MRKT 513

MRKT 587: Global Marketing

3 Credits

Exploration of strategic marketing planning concepts and techniques from a global perspective within diverse overseas market environments. MRKT 587 Global Marketing (3) This course is a systematic treatment and application of marketing management knowledge on a global scale. The objective of the course is to develop knowledge and understanding of the global marketing environment and of concepts, tools, and theory that will prepare students to take responsibility for successful global market penetration. The perspective of the course is managerial: i.e., the ability to identify market opportunities, develop plans/programs, resolve problems, and implement strategies. This course will provide graduate students with an understanding of marketing planning and strategy from a global perspective. The world should be viewed as a marketplace with a resulting need for familiarity with various environmental similarities and/or differences. These may necessitate adaptation and/or standardization

of marketing programs, strategies and plans from region/nation to region/nation. A major focus of this course will be a strategic marketing management techniques, issues, strategies and problems within a global marketing framework. As well, an understanding and appreciation of world cultures, socioeconomic, and legal/political conditions which have a profound effect on a US firm's target market selection and marketing strategy development, will be established.

Prerequisite: MRKT 513

MRKT 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

MRKT 597: Special topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

Master of Financial Engineering (MFE)

MFE 513: Financial Risk Management

3 Credits

This course covers the core concepts of risk management, allowing risk professionals and non-specialists to interpret risk management information and reports, make critical assessments, and evaluate the implications and the limitations of such results. In addition, they must commit to further uphold the highest professional and ethical standards. This course is directed toward students interested in understanding how large-scale complex risk can be quantified using the latest "cutting edge" techniques and case studies that generate "new knowledge" regarding how complex risk management situations might be managed. We identify the business and technical issues, regulatory requirements and techniques to measure and report risk across a major organization and to generate new ideas about how failures in risk management are resulting in new and improved procedures. The knowledge obtained in this course provides a theoretically-based approach that is necessary to effectively implement a superior risk management program. Successful candidates will be able to: 1. Acquire and analyze the techniques required to understand and incorporate corporate governance, compliance and risk management. 2. Implement integrated risk management based on sound theoretical underpinnings and new knowledge created by analyzing actual risk management failures. 3. Measure, manage and hedge market, credit (retail and corporate) and operational risk, with an emphasis towards improving existing "best practices" based on new knowledge. 4. Appraise the roles of board members and senior management in managing risk, cultivating potentially new solutions to risk management problems.

MFE 527: Derivative Securities

3 Credits

This course introduces the student to the major derivative securities that are the tools in the management of financial risk: futures, forwards,

swaps and options. The course will expose students to potential critiques of traditional financial theory based on recent empirical results, including the global financial crisis of 2007 - 2009. While examining the characteristics and pricing of these instruments, students will also explore how corporations utilize these contracts to reduce their financial risk exposure. The course also explores the practical differences between hedging, speculation and arbitrage. The objective of this course is to examine the important financial characteristics of derivative securities such as swaps, forward, futures, and options contracts and their roles in managing individual and corporate financial risk. Students will apply these concepts in an effort to integrate a comprehensive risk management approach. Among the topics explored for each of these securities are the history and evolution of formalized exchanges, the mechanics of each contract, price relationships, and the theory and practice of hedging. Basic valuation concepts as well as applications and strategies will be emphasized, as well as extensions based on recent innovations in financial engineering and the financial literature.

MFE 594: Research Topics

1-18 Credits/Maximum of 18

Supervised student activities on research projects identified on an individual or small-group basis.

MFE 801: Econometric Analysis

3 Credits

The aim of this course is to develop basic econometric estimation and hypothesis testing tools necessary to analyze and interpret the empirical relevance of financial and other economic data. The focus will be on the theoretical foundations of econometric analysis and strategies for applying these basic econometric methods in empirical finance research. The course includes the following topics: multivariate regression; maximum likelihood estimation; hypothesis testing; omitted variables and misspecification; asymptotic theory; measurement error and instrumental variables; time-series modelling; predictability of asset returns; econometric tests of the Capital Asset Pricing Model and multifactor models, and volatility modelling.

MFE 816: Financial Modeling

3 Credits

The course focuses primarily on developing spreadsheet applications and using the case method to apply decision-making procedures to real-world problems in finance areas. Students will be exposed to spreadsheets throughout the course to develop models that can be used in the financial decision-making process. Important financial topics such as financial ratio analysis, financial forecast, regression analysis, portfolio management, asset valuation, risk management, and capital budgeting decisions will be covered. Students will access market data through the internet and proprietary providers. Students will apply advanced skills such as Data Analysis tools, Advanced reporting, Monte Carlo simulation, and user-defined functions and macros. An overview of a scripting programming language in financial analysis/research will also be included.

MFE 821: Numerical Optimization for Finance

3 Credits

This course gives students an overview of the numerical optimization concepts and methods frequently used in financial engineering.

Building upon students' knowledge of programming and calculus, this course explores computational finance applications. Many classes of optimization problems will be explored, including linear, non-linear, integer, and dynamic programming. This course will combine theory (optimality conditions, for example) and how to apply the methods to asset allocation, risk management, option pricing, and cash flow matching. Students will also be exposed to using current software tools to solve optimization problems.

Prerequisite: (MFE 513, MFE 527, MFE 811) RECOMMENDED PREPARATIONS: Students must have basic understanding of programming, calculus, and finance. Three semesters of calculus and one semester of programming are recommended.

MFE 822: Stochastic Calculus in Finance

3 Credits

This course is designed to give students an overview of the techniques of stochastic calculus. Building upon a student's calculus and statistical background, the course explores how to model systems that behave randomly. Applying the concepts to financial models, students will explore both discrete and continuous time processes. Major objectives in this course include covering the concepts of arbitrage and risk-neutral pricing, discrete-time models, continuous time models, Markov processes, Brownian motion, and the Black-Scholes model. Throughout the course, students will apply the techniques learned to real world problems in areas such as stock prices, bond interest rates, and portfolio management.

Prerequisite: MFE 513, MFE 811

MFE 830: Financial Engineering Capstone Project

3 Credits

This course will be an intensive/exploration/hands on course that will consist of two phases, Phase I will be a preparation phase in which the student will acquire on his/her own all the financial terminology to be used throughout the semester. Examples of the topics to be covered in this phase include asset pricing, statistical analysis of high-frequency data, merger and acquisitions, portfolio formation, assessment and traditional portfolio theory, and market anomalies. In Phase II students are required to select a topic from these areas and conduct a research project.

Prerequisites: MFE 513, MFE 527, MFE 801, STAT 805

MFE 895: Internship

1-18 Credits/Maximum of 18

Supervised, professionally oriented, off-campus, non-group instruction including field experiences, practicums, or internships. Written and oral critique of activity is required.

MFE 896: Individual Studies

1-9 Credits/Maximum of 9

Creative projects with a professional orientation, including non-thesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

MFE 897: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject with a professional orientation that may be offered infrequently; several different topics may be taught in one year or semester.

MFE 899: Foreign Studies

1-12 Credits/Maximum of 24

Courses with a professional orientation offered in foreign countries by individual or group instruction.

Masters in Business Administration (MBADM)

MBADM 571: Global Strategic Management

3 Credits

Integrating multiple functional business areas to resolve global business problems and improve organizational performance. As the capstone course in the online MBA program, this course covers the study of strategic management, and is designed to integrate many of the components and key concepts that students have studied throughout the core curriculum. This course will enable students to develop skills to deal with complex situations, identify and evaluate alternative courses of actions for their organizations, and communicate their assessments and recommendations succinctly yet comprehensively. This course centers on factors that influence the competitive behavior and performance of the firm and the major focus throughout is firm success. Upon completion of this course, students will be able to describe, analyze, explain, and apply strategy concepts and techniques to virtually any type of organization, business or otherwise, in its pursuit of competitive advantage. More importantly, students will be prepared to think logically and critically about actual strategic situations that managers confront. By the conclusion of this course, students will be able to take a strategic manager's perspective to resolve business problems and issues with the goal of improving their organizations' performance.

MBADM 810: Team Performance

3 Credits

Overview of concepts, applications, and research on group and team processes and performance in an organizational context. This course provides students with an understanding of team processes and performance as well as other current issues that affect interpersonal dynamics in the workplace. This course provides an overview of the concepts of groups and teams as related to process and performance in organization. The course will blend theory, research, and practice to enable students to create, manage, and participate in teams more effectively. Broad topic areas include team design, context, and process. Specific areas of focus include learning orientation; group process skills; managing emotions, diversity, and conflict in groups; various workplace teams (e.g., virtual, cross-functional); and designing effective teams.

MBADM 811: Financial Accounting

3 Credits

Accounting rules, practices, and applications that characterize the accounting presentations that for-profit organizations provide to the

public. This course provides students with a foundation in the basic principles, procedures, and objectives of financial accounting that govern the reporting of information about a business to individuals, institutions, and other external groups. Course content focuses on: (1) conveying the conventions and institutional framework that define accounting rules and practice, including basic exposure to Generally Accepted Accounting Principles; (2) developing familiarity with financial statements; (3) teaching fundamental accounting transactions; and (4) training students in rudimentary analysis of the financial statements. Participation in synchronized discussions at specified times will be required.

MBADM 812: Economics for Business Strategy

3 Credits

Introduction to microeconomic and macroeconomic environments of business, pricing determination, market structures, and formulation of competitive strategy. This course is concerned with the economics way of thinking, the economics of effective management, the economic foundation of business strategy, and the economic environment of business. It draws on, and integrates, microeconomic and macroeconomic principles to bring new insights to business strategy and effective management. It provides a study of how markets are structured, how competitors and market participants behave, how prices and levels of activity in the business firm are determined, and how pricing is used by firms as a competitive strategy. The elements of the demand-and-supply framework are used to explain and resolve issues concerning production and sales levels, resource acquisition and allocation, and new value propositions. Also introduced are the basics of macroeconomics in the analysis of business cycles and in an understanding of government policies intended to influence the economic environment and affect where and how firms choose to compete. The effects of the global context (e.g., exchange rate policies, etc.) on economic conditions and business landscapes are analyzed. Throughout this course, students will be engaged in discussion of economic concepts and theories relevant to the concepts of competitive forces, competitive advantage, and competitive strategy, as well as the industry environment (market and competitors and their behaviors) and the industry's general economic environment. They will gain an understanding of how markets affect the elements of the firm's internal operations and how markets shape the firm's external environments which are often challenging and complex. They will also learn how to use the concepts and theories covered in this course to formulate a business strategy for the firm.

MBADM 813: Data Analysis for Decision Making

3 Credits

Applying statistical concepts to quantify uncertainty and gain insights from data in business settings. This course is designed to provide students with an exposure to the most commonly used statistical concepts, methods, and techniques, and their applications to business problems. The course covers the basic concepts of business statistics and data analysis using appropriate statistical software. The course emphasizes practical applications and business decision-making under uncertainty.

MBADM 814: Leadership Communications and Change Management

3 Credits

This course provides students with an overview of current theories and practices of organizational communication through the application and understanding of organizational change models. The primary aim is to

enhance written, oral, and graphic communication by applying, assessing, and presenting organizational change assessments in team and individual forums. The course focuses on developing an understanding of the paradigm shift necessary to achieve organizational transformation and re-conceptualization of management principles through effective and efficient communication.

MBADM 815: Ethical and Responsible Business Leadership

3 Credits

Managing ethical conduct in organizations, including corporate social responsibility, sustainability, and stakeholder analysis. This course develops students' ability to understand and manage ethical conduct and social responsibility in business organizations. Topics and readings teach students to identify and understand their values with respect to others' and common ethical dilemmas. Philosophical and prescriptive approaches to decision making are applied to real and hypothetical ethical dilemmas. Individual differences and cognitive barriers are studied to understand their role in ethical judgement. Students learn to voice their values and to analyze whistle-blowing situations. Techniques for leading individuals and teams toward ethical conduct are discussed. Organizational culture is audited to understand its role in corporate actors' decision making. Corporate social responsibility, stakeholder analysis, and sustainability are discussed from an historical and applied perspective. Global issues including bribery, human rights, corruption, and global standards as guiding principles are discussed.

MBADM 816: Managing and Leading People in Organizations

3 Credits

Overview of human behavior in organizations, and implications for managing and leading individuals, teams, and organizations. This course provides an overview of the theories, concepts, applications, and research findings of human behavior in formal organizations and their implications for individual, team, and organizational performance. This study of organizational behavior and performance will take place at three levels of analysis: (1) The Individual in the Organization, including topics such as personality, attitudes, perception, and motivation; (2) Groups in Organizations, including group and team dynamics, influence and political behavior, negotiation, and managing conflict, and; (3) Organizational Processes, such as work design, behavior modification, communication, and decision making.

MBADM 820: Financial Management

3 Credits

Application of techniques available to aid managers in sound financial decision making. This course is an intensive examination of techniques available to aid the financial manager in decision making. It is designed to provide the principles and tools of sound financial decision making involving cash flows over time under uncertainty. The course is also a basis and prerequisite for other graduate courses in finance and business. The topics covered include time value of money, valuation of bonds and stocks, capital budgeting, risk and return, valuation of a firm, capital markets and financing, international finance, and options.

Prerequisite: MBADM 811

MBADM 821: Marketing in a Global Environment

3 Credits

Examining strategic issues in global marketing, including opportunity analysis, planning, and implementation. This is a comprehensive marketing management course examining strategic issues in marketing. The areas of analysis, planning, implementation, and control of marketing activities and processes are examined. Marketing is presented as more than a business function; but rather, a philosophy of doing business. The main emphases of the course are on market assessment and measurement; analysis of consumer and business markets and buyer behavior; competitive marketing strategies; market segmentation, target marketing, and positioning strategy; product development and commercialization; pricing; channels of distribution; and communication and promotion strategies. The course uses a combination of readings, online discussions, presentations, group projects and a comprehensive simulation to help students not only gain a broad understanding of marketing strategies but also acquire hands-on experience in taking control of an enterprise operation involving marketing, production, and financial decision making at both strategic and tactic levels.

MBADM 822: Managing Supply Chains in Global Markets

3 Credits

Analyzing and applying key concepts, tools, and strategies in managing supply chains in global markets. This course addresses the concepts, tools, and strategies required to manage supply chains in a global market environment. The primary focus of the course is to enable students to develop a good understanding of strategic, tactical, and operational issues of Supply Chain Management (SCM) and to apply the various SCM concepts, tools, and strategies to make decisions for effective and efficient management of supply chains. The concepts of supply chain management are linked to provide an integrated decision making framework for managers. Specific skills acquired in this course include those needed for Inventory management, Network modeling, Contracting in Supply Chains, understanding the Value of Information, building strategic Alliances, Distribution strategies, Procurement strategies, Risk management, Supply chain design, and Global logistics.

Prerequisite: MBADM 813**MBADM 830: Managing in the Digital Economy**

3 Credits

How digital innovation, technology, and market disruption transforms industries, business practices, and market strategies. This course addresses the ways digital technological innovations transform industry, business models, strategies, operations, and management, and create new markets and products. The Economics and Markets module builds a foundation for understanding the role of disruptive technologies and their transformational impact on business strategies and models. The module has three focus areas - behavioral and informational economics, power laws, and platform competition. The Disruptive Information Technologies module is based on Clayton Christensen's concept of disruptive innovations with discussions centered on Clouds and Mobility, Internet of Things, 3D printing, robotics, transportation. The Implications of Data module focuses on the collection, analysis, and use of massive amounts of data driven by digital technologies. The topics covered include big data, privacy and security, search and ad technologies, health, and current/emerging topics. The Transformational Impact module

discusses strategic implications of digital innovations on work, business, industry, and society.

MBADM 850: Corporate Innovation and Entrepreneurship

3 Credits

This course focuses on understanding, exploring, and applying innovation-related concepts, principles, and practices to corporate environments involved with product development, new venture creation, and other contexts, such as startup companies. Innovation and creativity are examined from multiple perspectives and levels of analysis, including individual, team, organization, industry, business process, culture, and technology, to name a few. In addition, this course seeks to demonstrate how innovation, and its associated best practices, can be integrated and applied to improve organizational performance. This course is intended to provide a broad overview of corporate innovation and entrepreneurship that students can build upon in a work or educational setting. Students will learn the basics of how to assess innovation competency maturity, perform innovation processes and activities in an organization, and identify opportunities and ideas that can lead to new venture creation.

Recommended Preparation: A minimum of two years of business or similar organizational experience.

Materials Science and Engineering (MATSE)

MATSE 501: Thermodynamics of Materials

3 Credits

MATSE 501 Thermodynamics of Materials (3) The goal of this course is to teach the fundamental principles of thermodynamics of materials from a practical viewpoint - thermodynamics as a "toolbox" to help understand chemical behavior of materials. It attempts to integrate chemistry, phase equilibria, and thermodynamics of a materials system as different means of describing the same chemical behavior. It develops quantitative relationships among them. Thermodynamic terms/values are defined in terms of measurable quantities such as temperature, pressure (partial pressures), and concentrations to diminish the abstract nature of thermodynamics. The course emphasizes problem solving, and more specifically, developing explanations and understanding of chemical and thermal behavior observed in the laboratory/industry. A integral part of the course is to teach the use of state-of-the-art equilibrium thermodynamics computer software as an aid in performing calculations, particularly those involving chemically complex systems with many species.

Prerequisite: MATSE401 or equivalent**MATSE 503: Kinetics Materials Processes**

3 Credits

This course covers fundamentals of atomistic theories and phenomenological descriptions of kinetic processes in solids. It provides the foundation for the advanced understanding of materials processing, phase transformations, and microstructural evolution. Topics include atomistic mechanisms of diffusion, solutions to the phenomenological diffusion equation, diffusion along extended defects, gas-solid reactions, phase transformations, computer simulation of diffusional processes, and microstructure evolution.

Prerequisites: CHEM 450 or GEOSC 521 or MATSC 501

Cross-listed with: CMPMT 503

MATSE 504: Solid State Materials

3 Credits

The main course objective is to present fundamental concepts and models to develop students' quantitative understanding of mechanical, electrical, optical, and thermal phenomena in solid-state materials. Emphasis is placed not only on the discussion of material properties, but also on building a comprehensive understanding of how structure affects properties in solid state materials and vice versa. An overview of quantum mechanics is given and applied to understanding confinement effects and their implication for electronic and optical properties in nanostructured materials. It is further used to provide a solid foundation for understanding LCAO, MO theory, and tight binding approximations as powerful tools towards a modern understanding of structure property relationships in materials science, bridging all the way from the atomic scale of structure to macroscopic scale of properties. The course content is reinforced by utilizing interactive simulation programs. The structure and physical properties of most solids can be understood from fundamental building blocks developed in the last century, namely, crystal structure and symmetry of the organization of atomic nuclei in a solid, and the organization of electrons throughout this periodic Coulombic potential generated by the nuclei in a crystal. These are the essential concepts that will be emphasized in this course. It will begin with a description of crystal structure and diffraction theory to understand the crystal structure in real and momentum spaces in the form of a review. This will be followed by classical and semi-classical description of solids beginning from the free electron theory in metals, to tight binding theory in insulators, and band structure in semiconductors. Examples are given for how these different materials are employed in modern electronics and optoelectronics. One of the unique aspects of this course is that computer simulations will be used to aid in "visualizing" the concepts learnt in the class to develop an intuitive understanding of the structure in solid-state materials and their properties. The goal of the course is to equip the student with the knowledge necessary to master the modern framework in solid state materials that describes phenomena, such as electronic band structure, electronic transport, and the vibrational and thermal properties of solid state materials at an atomic level, and to prepare them for higher level graduate courses. The course is suitable for anyone interested in the science and engineering aspects of materials.

MATSE 506: Interfacial Electrochemical Processes

3 Credits

Electrochemical processes play a pivotal role in the development of new energy storage devices, energy-efficient material separation processes, and corrosion-resistant materials. This course covers the thermodynamic and transport properties of electrochemical systems, electrochemical characterization techniques, and their application in materials research. The course gives students an overview of the fundamental principles of electrochemical cells and electrode reactions based on the thermodynamic and transport properties at the electrode-electrolyte interface. The course will begin with thermodynamics of electrode reactions both in aqueous and non-aqueous electrolytes (e.g., molten salts), including the measurement techniques and Pourbaix diagrams. Then, the course will progress to kinetic aspects of electrode reactions, followed by the electrochemical characterization methods to determine critical kinetic parameters (e.g., exchange current density, diffusivity, and Tafel constants) based on dc (e.g., controlled potential,

controlled current, and cyclic voltammetry) and ac techniques (e.g., a.c. voltammetry and impedance spectroscopy). Throughout the course, the application of electrochemical principles in modern materials research and processes will be covered, including electrochemical separation processes (e.g., electroplating, electrorefining, and electrowinning cells) of energy materials, evaluation of corrosion-resistant alloys, and electrochemical power sources (e.g., batteries and fuel cells).

PREREQUISITE MATSE 401 MATSE 402

MATSE 507: Biomaterials Surface Science

3 Credits

Special properties of surfaces as an important causative and mediating agent in the biological response to materials. BIOE 517 BIOE 517. (MATSC 517) Biomaterials Surface Science (3) This course will factor the classical picture of the biological response to materials into spatial and temporal components, identifying the special properties of surfaces as an important causative and mediating agent. Emphasis will be on biophysical mechanisms and the biological response to materials. Contact activation of blood plasma coagulation cascade, bioadhesion, and protein adsorption will be repeatedly used as example biological response to materials surfaces to illustrate concepts and principles. Leading theories attempting to correlate both kinds of intensity of biological responses to surface and interfacial energetics will be compared and contrasted through a process that will quantify important surface thermodynamic properties of materials. The hydrophobic effect and related phenomena, especially as this pertains to water solvent effects in biology, will receive special emphasis. A general background in chemistry and/or biology is required, but prerequisites are purposefully limited, reflecting the interdisciplinary aspects of the subject and to draw students from different specializations.

Cross-listed with: BIOE 517

MATSE 508: Biomedical Materials

3 Credits

Properties and methods of producing metallic, ceramic, and polymeric materials used for biomedical applications. BIOE 508 BIOE (MATSC) 508 Biomedical Materials (3) The topical content of this course will be grouped into 4 areas. A general introduction to selected aspects of physiology will be presented. This will provide the background necessary to appreciate the factors which govern the selection of biomedical materials. Specific emphases will be placed on the polymerization of biopolymers (polypeptides and polysaccharides) and the general relationships between conformation and biological function, the biochemistry of blood and blood surface interactions, the formation of teeth and bone and the relationships between microstructure, composition and function, the immune responses to implanted materials, the resorption of bone (osteoporosis), and the development of caries. The perspective placed on these topics will be that of materials science. The selection of ceramics for hard tissue prosthesis will be described. Orthopaedic and dental applications for ceramics will be discussed. Specific ceramic materials to be treated include dental porcelain, alumina- and zirconia-based ceramics, and bioglasses. Various classes of inorganic cements, gypsum, zinc phosphates, zinc carboxylates, silicates, and glass-ionomer cements will also be considered as ceramics. Hydroxyapatite, HAp-based composites and HAp-metal interactions will be discussed in particular. Relationships among physical properties, mechanical properties, and chemical interactions with biological fluids will be described. Dental and orthopaedic applications of metals will

be described. The fracture toughness of metals, their electrochemical responses in vivo, and the nature of the interfacial interactions with hard tissues will be treated. Dental amalgams and the noble metals for dental applications will be considered. Metals and alloys, such as Ti, Co-Cr, and stainless steel used in prosthetic applications will be described and their properties and limitations discussed. The phenomenon of stress shielding and the immune responses associated with the accumulation of metallic and polymeric particulate debris in the vicinity of an implant will be discussed in particular. Polymeric materials are important in a broad range of biomedical applications. Among these are soft tissue prostheses, hemostatic agents, dental restoratives, bone replacement materials, and surgical adhesives. In some applications, it is desirable that a polymeric material biodegrade while in others property retention is desirable. Because of the spectrum of applications for polymers, the topics to be covered will be limited with the intent to concentrate on hemocompatible polymers, acrylics used as bone cements, polyethylene used as bearing surfaces in prostheses, and dental resins and bonding materials. Other relevant polymers and their applications will be discussed.

Cross-listed with: BIOE 508

MATSE 509: Materials Science for Drug Delivery

3 Credits

Drug delivery systems (DDS) are technologies that improve pharmacokinetics and biodistribution of drugs with the goal to enhance therapeutic efficacy and reduce side effects. Key to successful development of DDS is to design drug vehicles that can deliver controlled amounts of drugs to the sites of interest for required periods of time by overcoming the challenges due to the complexity of biological systems. With the evolution of materials science and nanotechnology, a wide variety of materials ranging from polymeric or inorganic nanomaterials, hydrogels, bioresponsive/biomimetic/bioinspired materials, and micro/nanofabricated devices have been developed to fulfill the need for achieving maximum therapeutic outcomes of pharmaceuticals. The course will be designed to present the importance of integrating the knowledge and technologies of materials science, engineering, chemistry, biology, medicine and life science to advance this interdisciplinary research field. In addition, it will discuss how the developed technologies provide innovative approaches to translate basic knowledge into healthcare technologies. For this purpose, the course will first focus on the principles of drug therapy, therapeutic targets and requirements for designing drug delivery systems. It will also cover the general aspects of interaction with materials with biological systems, including relationships between properties of materials and their interactions with proteins, blood, and cells, clearance of materials in the body, and strategies to design materials to avoid these foreign body responses. These points will be explained from the viewpoint of materials scientists, chemists, and engineers. The course will also discuss the applications of different types of materials for drug delivery, including polymeric nanomaterials, organic-inorganic hybrid materials, hydrogels and microfabricated devices. In this part of the course, the historical overview as well as recent research progress in this field will be discussed to explain the strategies and methodologies to develop new materials for a wide variety of therapeutics including chemotherapeutics, nucleic acids, proteins, bioimaging reagents, reactive oxygen species and gaseous signal transmitters. Furthermore, the course will discuss the current challenges in the drug delivery research field, and future directions. Throughout the course, recent research papers will be presented to discuss the on-going

research in this field, and develop the ability to read scientific articles critically.

MATSE 510: Surface Characterization of Materials

3 Credits

Physical and chemical principles of characterization techniques widely used in materials science, chemistry and engineering. CH E (MATSE) 510 Surface Characterization of Materials (3) Surface and interface characterization is an important subject in nanotechnology, heterogeneous catalysis, semiconductor processing, advanced functional materials, biomaterials, corrosion, environmental science, and tribology. This course will study the physical and chemical principles of representative characterization techniques widely used in these research areas. Topics covered in this course include surface chemistry and physics fundamentals, x-ray and electron-based spectroscopy, vibration spectroscopy, ellipsometry, microscopy with physical probes, and multivariate data analysis. Physical principles and practical applications will be studied through theoretical calculations, data analysis, and literature reviews.

Cross-listed with: CHE 510

MATSE 511B: Transmission Electron Microscopy

1 Credits

Principles and practice of transmission electron microscope operation. Students undertake individual projects.

Cross-listed with: GEOSC 511B

MATSE 512: Principles of Crystal Chemistry

3 Credits

Relation of structure to ionic size and nature; influence of pressure and temperature on structure; chemical-structural defects, crystalline solutions, phase-transitions. MATSE (GEOSC) 512 Principles of Crystal Chemistry (3) Crystal chemistry is concerned with the systematics of crystal structures as determined by ionic sizes and characteristics of chemical bonds and with changes in crystal structure with variations in temperature and pressure. The course begins with a short review of crystallography. It then proceeds to elements and ions as the building blocks of crystals. Models for the chemical bonds which bind elements and ions into crystals include classical electrostatic theory, crystal field theory, molecular orbital theory, and band theory. The principles underlying each model are explained. The next step in the buildup of crystals is to explain the principles of ionic packing, crystal defects, and the concepts of polymorphism and phase transitions. With the underlying principles and theory in place, the second half of the course deals with a systematic presentation of the various families of crystal structures, their properties, and some indication of the practical utilization of the various structural families. The discussion proceeds from binary packing structures to packing structures of ternary and quaternary composition, to metal structures, to silicate structures, to organic crystals, to defect structures and non-crystalline solids. The course is divided into seven parts, and grading is achieved by a 30-minute quiz following completion of each part. There is no suitable textbook, but a comprehensive set of printed notes is provided as are recommended readings of selected review articles and current literature. Students are also required to prepare a semester paper on a topic of their choice.

MATSE 514: Characterization of Materials

3 Credits

Classical and new (microprobe, scanning microscope, magnetic resonance, and Mossbauer) techniques for the characterization of composition, structure, defects, and surfaces. MATSE 514 Characterization of Materials (3) This course is designed for graduate and selected undergraduate students. The broad spectrum of the various materials characterization techniques will be briefly surveyed. Students will not be taught how to run specific instruments or be expected to be an expert on the analytical techniques. However, students will be given assignments that require a search of the literature and having discussions with the relevant experts to develop a detailed understanding of specific characterization techniques. Students will also be required to apply statistical methods in their assigned projects. The objectives of the course include the presentation of a survey of material characterization techniques, lectures on experimental design and use of statistical techniques, as well as problem-solving techniques. The goal is to provide students with a foundation in the use of characterization techniques to solve and diagnose material problems that can be identified and potentially resolved with materials characterization. The first part of the lectures provides a survey on many of the material characterization techniques. The second part of the course covers statistical analysis of experimental data including small population statistics, error analysis, curve fitting routines, and a brief survey of statistical experimental design. The third part of the course covers problem-solving techniques using materials characterization. Several characterization problems are given to the class that require the formation of project teams composed of 4 to 5 class members to resolve. Each project team prepares oral and written reports for the problem selected.

MATSE 520: Polymer Science and Engineering

3 Credits

This course provides fundamental understanding of basic principles in polymer science and connects these to current research topics at Penn State as well as novel findings in soft material science at other institutions. Interdisciplinary in content, the curriculum spans from polymer synthesis (chemistry), to physical properties (physics), to characterization, to engineering (chemical engineering), to application of polymer materials (materials science). Two areas of focus will lie on (i) the environmental impact of commodity plastics and (ii) conductive polymers and their every-day use in display technology and energy harvesting. While polymers are versatile and broadly applicable, there lie significant dangers in their use for us as a society. For example, while the drive for flexible displays and solar cells is increasing, there is no clear pathway for efficient recycling of the resulting electronic polymeric materials. To this end, this course will engage students in discussions about industrial processing of polymers and the importance to find new pathways for their recycling.

Cross-listed with: CHE 520, CHEM 520

MATSE 523: Environmental Degradation of Materials in Nuclear Power Plants

3 Credits

Degradation of materials performance when exposed to the combination of high temperature, neutron irradiation, and aggressive electrochemistry found in nuclear reactors.

Prerequisite: MATSE409

Cross-listed with: NUCE 523

MATSE 525: Communicating Topics in Materials Science

3 Credits

This course is designed to expand students' knowledge of materials science, engineering, and research. The course will cover the properties and applications of a broad range of materials based on each student's proposed research topic. Students will develop an understanding of the primary characterization methods that are used to study and measure the physical and chemical properties of the chosen material and how to appropriately communicate research ideas to their peers. Additionally, students will learn about the broader impacts of their work and the importance of broadening participation - each of which are required elements in NSF proposal.

MATSE 530: X-Ray Crystallography and Diffraction

3 Credits

Reciprocal lattices and the Ewald sphere construction; crystal structure determination by powder and single crystal techniques; space groups. MATSE 530 X-Ray Crystallography and Diffraction (3) MATSE 530 is a general introduction to the crystallography and x-ray diffraction for a variety of different studies of the structure of solids. Students will gain an understanding of basic crystallography, the geometry of diffraction measurements and instrumentation, and the interpretation of diffraction data. Diffraction studies using synchrotron radiation and neutrons are also discussed.

Prerequisite: MATSE430

MATSE 531: Transmission Electron Microscopy

3 Credits

Diffraction pattern analysis and simple contrast theory applied to the structures of materials; analytical techniques in the microscope. MATSE 531 Transmission Electron Microscopy (3) This course will present the fundamentals of elastic and inelastic electron beam interactions with solid-state materials. Students will learn theoretical and practical aspects of electron diffraction and imaging, energy-dispersive x-ray spectroscopy, and electron energy loss spectroscopy. They will learn how to apply this knowledge to conduct experiments in and interpret data from the transmission electron microscope.

MATSE 534: Advanced Solidification Processes in Metallic Materials

3 Credits

The emergence of advanced manufacturing processes, such as additive manufacturing, has introduced high levels of uncertainty in well-established process - structure - property- performance relationships. A comprehensive understanding of solidification across spatial and temporal scales is needed in order to identify the underlying phenomena driving these unique structures and properties. In this course, the processes driving solidification and the properties of liquid metals will be covered to provide a framework for understanding more complex solidification processes in multi-component systems. Building on a fundamental understanding of both the thermodynamics and kinetics of solidification processes, the properties of interfaces and nucleation and growth will be studied across a range of material systems, including those exhibiting eutectic and peritectic transformations. With this basic

knowledge, the role of complex processing conditions and their impact on multi-component alloy systems will be investigated for conditions prevalent in advanced manufacturing processes and correlated with advanced and emerging characterization tools.

Recommended Preparation: Students in this course should have a basic understanding (undergraduate level) of physical metallurgy principles, including solidification, solid-state phase transformations, heat treatment, and thermomechanical processing.

Cross-listed with: ESC 534

MATSE 535: Geometrical Crystallography

3 Credits

Derivation of lattices, types, point groups, and space groups; and group theory applied to crystallography and spectroscopy. MATSE 535 Geometrical Crystallography (3) Visual, mathematical, and group theory approaches are used to examine in detail the geometry of periodic, quasiperiodic, and incommensurate structures. From computer-assisted class discussions and weekly homework assignments, the student becomes familiar with the symmetry operations involved in translation, rotation, and color changes. Point groups, space groups, and color groups are derived through a combination of visual and mathematical considerations. The structure of group theory is then explored and applied to the derivation of space groups.

MATSE 540: Crystal Anisotropy

3 Credits

Symmetry aspects of crystals and physical properties. Matrix and tensor methods. MATSE 540 Crystal Anisotropy (3) In this course symmetry and tensors are used to describe the physical properties of materials as a function of direction, i.e., how a material will respond to different types of stimuli as a function of direction. A variety of thermal, mechanical, electric, magnetic, and optical properties are covered, including pyroelectricity, pyromagnetism, thermal expansion, dielectric constant, magnetic susceptibility, piezoelectricity, piezomagnetism, elastic stiffness and compliance, electrostriction, magnetostriction, index of refraction, and non-linear optical effects. At first the response of single crystals are considered, but this is later extended to polycrystalline samples with various types of texture. As the course makes extensive use of symmetry, several weeks are dedicated to the development of the 32 crystallographic point groups using group theory. Symmetry operations are described using coordinate transformation matrices and stereographic projections. Both tensor quantities and tensor properties are described as a function of increasing tensor rank (up to fourth rank) for a multitude of polar tensors followed by axial tensors. For magnetic materials, the 90 magnetic point groups are introduced. For polycrystalline materials, the 7 Curie groups are utilized. A variety of practical examples illustrating the use of tensors to describe the properties of materials are covered in class and in in-depth homework sets involving both matrix and tensor form. The computer program Mathematica is used extensively in class and in the homework sets to visualize the physical properties of materials in three dimensions as well as to rapidly apply symmetry and tensor methods to high-rank tensor properties of low symmetry materials.

Prerequisite: PHYS 412

MATSE 542: Polymeric Materials: The Solid State

3 Credits

Introduction to the fundamental concepts necessary to understand solid state structure and properties of polymer materials. MATSE 542 Polymeric Materials: The Solid State (3) This course will cover concepts important to understanding polymer solids and their physical properties. We will begin with the concept of (partial) crystallinity, and the solid state microstructure of semi-crystalline polymers and copolymers. The fundamentals of crystallization kinetics of polymers will be covered, as will the concept of 'annealing'. Wide-angle x-ray diffraction and small-angle x-ray scattering methods will be discussed in the context of characterization of crystalline polymer structure. A discussion of nanoscale associations in both crystalline and non-crystalline ion-containing polymers will complete the first portion of the course. Several classes on the liquid crystalline state will follow, together with discussion of lyotropic and thermotropic liquid crystalline polymers. The fundamentals of binary and ternary polymer mixtures will come next. Concepts important to both miscible blends (e.g. concentration fluctuations) and immiscible blends (e.g. rubber toughening) will be covered. The origin of the morphology (phase diagrams) and properties of di-, tri- and multiblock copolymers will be discussed, as will their role as interfacial agents in multiphase systems. The latter portion of the course will be concerned with electrical and mechanical properties. The former will focus on dielectric relaxation, and conductivity (both electronic and ionic). The latter will focus on the relationship between solid state structure and mechanical (including viscoelastic) properties.

Prerequisite: MATSE443 and MATSE445 or equivalent

MATSE 543: Polymer Chemistry

3 Credits

This graduate course discusses the new advances in polymer chemistry that leads to new polymeric materials with interesting structures and properties. CHEM (MATSE) 543CHEM (MATSE) 543 Polymer Chemistry (3) This course provides advance level of polymer chemistry and materials taught in MATSE 441 - Polymeric Materials. Students are able to know the versatility that is inherent in polymer chemistry and the new research results and activities, especially controlling polymerization, polymer structures, designing polymers with desirable properties, etc. Students shall also understand the major economic and environmental concerns and solutions in producing commercial-scale polymers. This polymer chemistry course provides important links between chemistry and polymeric materials. The course will focus on recent advances in polymer chemistry that affords new polymer materials with controlled polymer structures, compositions, and properties, as well as economic and "green" processes. This course is designed for graduate students having basic knowledge in organic, inorganic, and organometallic principles. For Chemistry major, this course offers students with the knowledge to apply chemical principles and methods to design and prepare the desirable polymers (no prerequisite for Chemistry graduate students). For Material Science and other majors, this course provides advance level of polymer chemistry and materials taught in MATSE 441 (a prerequisite course). In addition, each student will be required to review (presentation and term-paper) a contemporary subject relative to polymer chemistry, which will help student self-education, and presentation and writing skills. Students will be evaluated by quizzes and examinations, a term-paper and presentation, and class participation.

Prerequisite: MATSE441 or approval of program

Cross-listed with: CHEM 543

MATSE 544: Computational Materials Science of Soft Materials

3 Credits

Pursue applications of computational modeling methods to soft materials; explore use of these methods to different research areas.

MATSE 545: Semiconductor Characterization

3 Credits

Physical principles and experimental methods used to characterize the electrical, optical, structural and chemical properties of semiconductor materials.

Cross-listed with: EE 545

MATSE 546: Advanced Metallic Material Feedstocks for Additive Manufacturing

4 Credits

Additive manufacturing (AM) processes use a variety of metallic material forms to produce complex components. These material forms can vary from metallic powders with a rather wide range of size distributions to metal wire to sheet and other more complex composite material types. Knowledge of the processing of these different feedstock forms along with means to characterize them is needed to develop AM processes and procedures capable of being more widely used, particularly in critical applications. In this course, the production, handling, blending, and characterization of common metallic and composite feedstock materials will be covered. Feedstock forms to be addressed include metal and metal-ceramic composite powders, wire, and sheets, along with new product forms becoming available. A multi-disciplinary approach will be taken to elucidate the connections between production, characterization, and handling to develop an understanding of the role of feedstocks on the resulting process-structure-property relationships for AM processes and products.

Prerequisite: ESC 545 CONCURRENTS: MATSE 567, IE 527

MATSE 548: Dielectric and Other Electroceramics

3 Credits

Preparation and properties of ceramic semiconductors, dielectrics, and magnetic materials. MATSE 548 Dielectric & Other Electroceramics (3) This course reviews the fundamental underpinnings of electroceramic materials as used in passive, active, and sensor components, and systems. The recent literature and industrial trends are critically discussed within the course to aid students in identifying key material science problems to be solved in this area.

MATSE 552: Sintering of Ceramics

3 Credits

Design and interpretation of ceramic microstructures through an understanding of the physics and chemistry of sintering and grain growth. MATSE 552 Sintering of Ceramics (3) This course is about the processing of ceramic-based materials by sintering processes. Sintering is the thermal processing of a porous material which results in a decrease in surface free energy, strengthening and usually densification. The first half of the course covers the thermodynamics,

mechanisms, kinetics, and models for densification. The theory of grain growth and coarsening processes are also discussed. The relations between densification and grain growth are discussed as they influence microstructure evolution. Tools for characterizing sintering and grain growth processes are reviewed. Practical applications of sintering for the manufacture of ceramic-based components ranging from low temperature co-fired ceramics to transparent ceramics are discussed.

Prerequisite: MATSE411

MATSE 555: Polymer Physics I

3 Credits

Introduction to the fundamental concepts needed to understand the physics applicable to polymer melts, solutions and gels. MATSE (PHYS) 555 Polymer Physics I (3) This course develops fundamental understanding of the conformations of polymers in solution and melt states. We start with ideal chains that have random walk statistics. Next excluded volume is introduced to understand the self-avoiding walk conformation and collapsed conformation of real chains. The behavior ideal and real chains are studied in extension, compression and adsorption. While positive excluded volume leads to swelling, negative excluded volume leads to collapse and phase separation. The phase behavior of polymer mixtures and solutions is described in detail. Semidilute solutions are understood in terms of two length scales where each chain changes its conformational statistics. Scattering is used to determine the conformation of chains, their molar mass and their interactions with surroundings. Percolation theory is introduced to model the statistics of random branching and gelation. The rubber elasticity of fully developed networks is understood in terms of the stretching laws for network chains. Entanglement effects, swelling and viscoelasticity are discussed in detail. Once the conformations of polymers are understood, dynamics of polymer liquids are considered. In dilute solutions hydrodynamic interactions dominate and the viscoelasticity predicted by the Zimm model is derived. In unentangled melts of short chains, hydrodynamic interactions are screened and the Rouse model is used to understand viscoelasticity. Unentangled polymers in semidilute solutions have Zimm dynamics on small length scales and Rouse dynamics on longer length scales. Dynamic scattering techniques are discussed for measuring polymer dynamics. Entanglement effects are described using the tube model, where surrounding chains confine the motion of a given polymer to a tube-like region. The effects of concentration, chain length and polydispersity of linear chain polymer liquids are discussed in detail. The effects of branching on polymer dynamics are introduced at the level of simple structures such as star polymers and comb polymers. The course assumes some prior knowledge of polymers, usually obtained through an introductory undergraduate course. The students should attain a working understanding of the basic concepts of polymer physics in this course, allowing them to tackle more difficult problems in their research. Such skills are reinforced through homework and take-home examinations.

Cross-listed with: PHYS 555

MATSE 556: Polymer and Composite Materials for Additive Manufacturing

3 Credits

This course will focus on how polymers are used in 3D printing including topics of thermal processing, photopolymerization, composites, and modern topics at the intersection of polymer science and additive manufacturing. Of particular importance will be the description of how

additive manufacturing processes influence the final properties of polymeric and composite materials. The details of polymer chemistry and material structure will be covered to give students foundational knowledge in materials and additive processes. Basic ASTM processes in additive manufacturing will be described along with hybrid processes and topics in modern research. This course will give students a competitive advantage in understanding both materials and new manufacturing processes. The unique aspects of additive manufacturing will be discussed in the context of manufacturing economics and its impact on polymer processing as the industry and the technology develops.

MATSE 560: Hydrometallurgical Processing

3 Credits

Fundamental physico-chemical factors underlying the aqueous extraction and recovery of metals and nonmetals from ores, minerals, and scrap metal. MN PR 507 (MATSE 560) Hydrometallurgical Processing (3) This 3-credit course is concerned with the fundamental physico-chemical processes associated with the processing, utilization, and recycling of materials in aqueous systems. The topics covered cut across a wide range of practical applications. The course is therefore suitable for a broad spectrum of scientists and engineers concerned with processes and processing in aqueous systems, e.g., in materials science and engineering, mineral processing, geoscience, soil science, environmental engineering, chemistry, chemical engineering, petroleum and natural gas engineering, mining engineering, nuclear engineering, and electronic and electrical engineering. A required term paper provides a formal mechanism for ensuring that students have the opportunity to apply ideas discussed in the course to their specific areas of interest.

Prerequisite: MATSE426

Cross-listed with: MNPR 507

MATSE 564: Deformation Mechanisms in Materials

3 Credits

Deformation of crystalline/amorphous solids and relationship to structure; elastic, viscoelastic and plastic response over a range of temperatures and strain rates. EMCH 535 / MATSE 564 Deformation Mechanisms in Materials (3) The course will study the relationship between the deformation mechanisms in materials and their structure. The types of deformation behavior considered in the course are linear elasticity (isotropic or anisotropic), viscoelasticity and plastic deformation. For the elastic behavior, the emphasis will be on the way elastic behavior is controlled by atomic structure and microstructure. The constitutive laws that describe this behavior and the assumptions on which they are based will be introduced. The next phase of the course considers the range of deformation behavior from purely viscous (linear or non-linear) to viscoelastic. Initially, the emphasis will be on the effects of temperature and strain history and the way this behavior is described by mechanical analogs. The effect of structure on creep and stress relaxation will be described. The use of linear viscoelasticity in describing the sintering process will also be included. In ductile crystalline materials, deformation is associated with the movement of dislocations. The types of dislocations, their stress fields and energies will be described. These aspects will then be combined with structural features by including considerations of slip geometry and obstacles to dislocation motion. This approach will allow strengthening methods to be identified and quantified. Finally, creep mechanisms in crystalline materials at high temperature will be discussed and quantified.

Prerequisite: E SC 414M or MATSE436

Cross-listed with: EMCH 535

MATSE 565: Metals in Electronics

3 Credits

Processing and performance of metals in electronics, covering electrical resistivity, metal film deposition, metal/semiconductor contacts, interconnects, and electronic packaging. MATSE 565 Metals in Electronics (3) This course addresses the processing, use, and performance of metals in electronics. The course is intended to provide students with a background in semiconducting or other electronic materials with specific knowledge about the application of metals in electronics as well as to allow students with a metallurgical background to learn about how their expertise fits into the electronics industry. Topics covered include electrical resistivity in thin metal and alloy films, deposition of thin metal films, metal/semiconductor contacts, interconnects in microelectronics, electromigration, diffusion barriers, electronic packaging, and metal/metal contacts. Grades are based on homework problems, a term paper, and class presentations. The course is offered in alternate fall semesters.

MATSE 567: Additive Manufacturing of Metallic Materials

3-4 Credits

This course will expose students to the state of the art in understanding processing, structure, and property relationships in materials fabricated using additive manufacturing (AM). There will be a strong focus on metallic alloys, but polymers, ceramics, and advanced materials will also be briefly discussed. The emphasis of the course will be on understanding the links between processing and the resulting structure, as well as the microstructure and the mechanics of the fabricated materials. Initially, we will discuss the types of AM and the feedstock materials required for these processes. We will then focus on metals, and discuss the energy sources used in AM (lasers, electron beams), and their interactions with the material. We will discuss the molten pool characteristics and the solidification microstructures. We will relate the microstructures seen in AM to the resulting mechanical properties (elastic deformation, plastic deformation, fracture, fatigue performance, and residual stress/distortion). Finally, we will discuss specific case studies for metals, polymers, ceramics, and advanced materials.

Cross-listed with: AMD 567

MATSE 570: Catalytic Materials

3 Credits

Preparation and characterization of solid catalytic materials and the relationships between their surface, defect, and electronic properties and catalytic activity. MATSE (EME) 570 Catalytic Materials (3) This course covers the preparation and characterization of solid catalytic materials, and the relationships between the surface and electronic properties and pore structure of the materials and their catalytic activity and selectivity. The course includes the following materials: zeolites and molecular sieves; metals and alloys; metal oxides; metal sulfides; and other catalytic materials. Also included are the major applications of catalytic materials in chemical and petroleum industries and in other manufacturing industries for environmental protection. This course can be grouped into three parts: (1) introduction to catalysis and analytical techniques; (2) synthesis and characterization of catalytic materials; and (3) catalysis at surfaces of solid materials. The course is suitable for a broad spectrum of students in energy and mineral engineering, materials

science and engineering, fuel science, chemical engineering, chemistry, solid-state science, and environmental engineering.

Prerequisite: CHEM 452 or similar course in chemical, materials or energy sciences and engineering
Cross-listed with: EME 570

MATSE 575: Functional Polymeric Materials

3 Credits

In-depth discussions of structure/property relationships in functional polymers and modern concepts of structural design of polymers.

MATSE 580: Computational Thermodynamics

3 Credits

The integration of fundamental principles and advanced computational approaches in the thermodynamics of materials, including hands-on computation, theory and application.

Prerequisite: MATSE501 or equivalent

MATSE 581: Computational Materials Science II: Continuum, Mesoscale Simulations

3 Credits

This course will focus on computational techniques and fundamentals of phase transformation simulations on the continuum, mesoscale level. MATSE 581 Computational Materials Science II: Continuum, Mesoscale Simulations (3) This course will focus on computational techniques and fundamentals of phase transformation simulations on the continuum, mesoscale level. The objective of the course is to introduce the evolution of simulation techniques and integrate fundamental principles in thermodynamics and kinetics with advanced computational approaches. The teaching will be problem-oriented using literature publications. There will be many hands-on computer exercises to gain experience in presenting problems to computer and interpreting the computer results. This course is particularly useful for students who would like to explore the power of computational approaches and would like to understand the thermodynamic and kinetic principles behind computational phase transformations.

Prerequisite: MATSE501 and MATSE503

MATSE 582: Materials Science and Engineering Professional Development

1 Credits

This course covers ethical conduct of research, pathways of professional development and strategies and tools for research.

MATSE 590: Colloquium

1 Credits/Maximum of 1

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

MATSE 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

MATSE 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

MATSE 597B: **SPECIAL TOPICS**

1-3 Credits

Cross-Listed

MATSE 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

MATSE 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

MATSE 602: Supervised experience in college teaching

1-3 Credits/Maximum of 6

Supervised assistance with the teaching program in metallurgy. MATSE 602 Supervised Experience/College Teaching (1-3) This course provides the opportunity for graduate students to learn college teaching by assisting a faculty member with an undergraduate or graduate course.

MATSE 801: Foundations in Materials Science for the Professional Engineer

3 Credits

Materials science is ubiquitous. All modern industry is highly dependent on materials whose properties can be controlled or engineered to accommodate a wide range of applications. The multidisciplinary field of materials science and engineering outlines approaches to enhance the manipulation of existing materials and synthesis of new materials. Further, the study of materials science and engineering provides the basis for understanding material properties with respect to chemistry and atomic structure and specifically the ability to tailor chemistry and structure in order to bring about specific properties (materials by design). Finally, an understanding of materials from a structure-processing-properties point of view allows for troubleshooting of modern manufacturing with respect to materials outcomes. Students will investigate why particular materials perform with specific properties while other materials do not. Students will then investigate how materials can be manipulated to perform actions that are typically not expected from a particular material. The previous two investigations will then allow students to begin to create materials by design to serve in specific industrial and environmental settings. All of these actions will be supported by the student's acquired knowledge of the role of

fundamental chemistry, physics and math in describing, measuring, and predicting materials performance.

Mathematics (MATH)

MATH 501: Real Analysis

3 Credits

Lebesgue measure theory. Measurable sets and measurable functions. Lebesgue integration, convergence theorems. L_p spaces. Decomposition and differentiation of measures. Convolutions. The Fourier transform. MATH 501 Real Analysis I (3) This course develops Lebesgue measure and integration theory. This is a centerpiece of modern analysis, providing a key tool in many areas of pure and applied mathematics. The course covers the following topics: Lebesgue measure theory, measurable sets and measurable functions, Lebesgue integration, convergence theorems, L_p spaces, decomposition and differentiation of measures, convolutions, the Fourier transform.

Prerequisite: MATH 404

MATH 502: Complex Analysis

3 Credits

Complex numbers. Holomorphic functions. Cauchy's theorem. Meromorphic functions. Laurent expansions, residue calculus. Conformal maps, topology of the plane. MATH 502 Complex Analysis (3) This course is devoted to the analysis of differentiable functions of a complex variable. This is a central topic in pure mathematics, as well as a vital computational tool. The course covers the following topics: complex numbers, holomorphic functions, Cauchy's theorem, meromorphic functions, Laurent expansions, residue calculus, conformal maps, topology of the plane.

Prerequisite: MATH 501

MATH 503: Functional Analysis

3 Credits

Banach spaces and Hilbert spaces. Dual spaces. Linear operators. Distributions, weak derivatives. Sobolev spaces. Applications to linear differential equations. MATH 503 Functional Analysis (3) This course develops the theory needed to treat linear integral and differential equations, within the framework of infinite-dimensional linear algebra. Applications to some classical equations are presented. The course covers the following topics: Banach and Hilbert spaces, dual spaces, linear operators, distributions, weak derivatives, Sobolev spaces, applications to linear differential equations.

Prerequisite: MATH 501

MATH 504: Analysis in Euclidean Space

3 Credits

The Fourier transform in L^1 and L^2 and applications, interpolation of operators, Riesz and Marcinkiewicz theorems, singular integral operators.

Prerequisite: MATH 502

MATH 505: Mathematical Fluid Mechanics

3 Credits

Kinematics, balance laws, constitutive equations; ideal fluids, viscous flows, boundary layers, lubrication; gas dynamics.

Prerequisite: MATH 402 or MATH 404

MATH 506: Ergodic Theory

3 Credits

Measure-preserving transformations and flows, ergodic theorems, ergodicity, mixing, weak mixing, spectral invariants, measurable partitions, entropy, Ornstein isomorphism theory.

Prerequisite: MATH 502

MATH 507: Dynamical Systems I

3 Credits

Fundamental concepts; extensive survey of examples; equivalence and classification of dynamical systems, principal classes of asymptotic invariants, circle maps.

Prerequisite: MATH 502

MATH 508: Dynamical Systems II

3 Credits

Hyperbolic theory; stable manifolds, hyperbolic sets, attractors, Anosov systems, shadowing, structural stability, entropy, pressure, Lyapunov characteristic exponents and non-uniform hyperbolicity.

Prerequisite: MATH 507

MATH 511: Ordinary Differential Equations I

3 Credits

Existence and uniqueness, linear systems, series methods, Poincaré-Bendixson theory, stability.

Prerequisite: MATH 411 or MATH 412

MATH 513: Partial Differential Equations I

3 Credits

First order equations, the Cauchy problem, Cauchy-Kowalevski theorem, Laplace equation, wave equation, heat equation.

Prerequisite: MATH 411 or MATH 412

MATH 514: Partial Differential Equations II

3 Credits

Sobolev spaces and Elliptic boundary value problems, Schauder estimates. Quasilinear symmetric hyperbolic systems, conservation laws.

Prerequisite: MATH 502, MATH 513

MATH 515: Classical Mechanics and Variational Methods

3 Credits

Introduction to the calculus of variations, variational formulation of Lagrangian mechanics, symmetry in mechanical systems, Legendre transformation, Hamiltonian mechanics, completely integrable systems.

Prerequisite: MATH 401 , MATH 411 , or MATH 412

MATH 516: Stochastic Processes

3 Credits

Markov chains; generating functions; limit theorems; continuous time and renewal processes; martingales, submartingales, and supermartingales; diffusion processes; applications.

Prerequisite: MATH 416

MATH 517: Probability Theory

3 Credits

Measure theoretic foundation of probability, distribution functions and laws, types of convergence, central limit problem, conditional probability, special topics.

Prerequisite: MATH 403

Cross-listed with: STAT 517

MATH 518: Probability Theory

3 Credits

Measure theoretic foundation of probability, distribution functions and laws, types of convergence, central limit problem, conditional probability, special topics.

Prerequisite: STAT 517

Cross-listed with: STAT 518

MATH 519: Topics in Stochastic Processes

3 Credits

Selected topics in stochastic processes, including Markov and Wiener processes; stochastic integrals, optimization, and control; optimal filtering.

Prerequisite: STAT 516 , STAT 517

Cross-listed with: STAT 519

MATH 523: Numerical Analysis I

3 Credits

Approximation and interpolation, numerical quadrature, direct methods of numerical linear algebra, numerical solutions of nonlinear systems and optimization. MATH 523 Numerical Analysis I (3) 1. Approximation and interpolation. Weierstrass theorem, Bernstein polynomials, Jackson theorems, Lagrange interpolation, least squares approximation, orthogonal polynomials, piecewise Lagrange and Hermite interpolation, spline interpolation, the Fast Fourier Transform.2. Numerical quadrature. Newton-Cotes rules, Peano Kernel Theorem, Euler-Maclaurin expansion, Romberg integration, Gaussian quadrature, adaptive quadrature.3. Direct methods of numerical linear algebra. Gaussian elimination with pivoting, backward error analysis, conditioning of linear systems.4. Numerical

solution of nonlinear systems and optimization. One-point iterations, Newton's and quasi-Newton's method, Broyden's method, unconstrained optimization, line-search methods.

Prerequisite: MATH 456

MATH 524: Numerical Linear Algebra

3 Credits

Matrix decompositions. Direct method of numerical linear algebra. Eigenvalue computations. Iterative methods. MATH 524 Numerical Linear Algebra (3) This course provides a graduate level foundation in numerical linear algebra. It covers the mathematical theory behind numerical algorithms for the solution of linear systems of equations and eigenvalue problems. Specific topics include: matrix decompositions, direct methods of numerical linear algebra, eigenvalue computations, iterative methods.

Prerequisite: MATH 535

MATH 527: Topology

3 Credits

This course provides an overview of the fundamental concepts of Geometric and Algebraic Topology and presents examples of calculations of principal topological invariants. It starts with review of general topology and covers the following topics: fundamental group, homology theories, index theory, CW complexes, and examples of calculations.

Prerequisite: MATH 429

MATH 528: Differentiable Manifolds

3 Credits

Smooth manifolds, smooth maps, Sard's theorem. The tangent bundle, vector fields, differential forms, integration on manifolds. Foliations. De Rham cohomology; simple applications. Lie groups, smooth actions, quotient spaces, examples. MATH 528 Differentiable Manifolds (3) This course covers the foundations of differential geometry, developing the theory of differentiation and integration on manifolds. It provides tools for the study of nonlinear problems, combining techniques in analysis and geometry. Concepts and tools from differential geometry have found wide use in different areas of mathematics, including nonlinear differential equations, control and optimization problems, and numerical analysis. The goal is to cover the most important techniques of differential geometry in a concise way. The course will appeal not only to students who plan to do research in geometry, but also to those interested in analysis, or applied and computational mathematics, as well. It covers the following topics: smooth manifolds, smooth maps, Sard's theorem, the tangent bundle, vector fields, differential forms, integration on manifolds, foliations, de Rham cohomology, Lie groups, smooth actions, quotient spaces, examples.

Prerequisite: MATH 527

MATH 529: Algebraic Topology

3 Credits

Manifolds, Poincare duality, vector bundles, Thom isomorphism, characteristic classes, classifying spaces for vector bundles, discussion of bordism, as time allows.

Prerequisite: MATH 528

MATH 530: Differential Geometry

3 Credits

Distributions and Frobenius theorem, curvature of curves and surfaces, Riemannian geometry, connections, curvature, Gauss-Bonnet theorem, geodesic and completeness.

Prerequisite: MATH 528**MATH 533: Lie Theory I**

3 Credits

Lie groups, lie algebras, exponential mappings, subgroups, subalgebras, simply connected groups, adjoint representation, semisimple groups, infinitesimal theory, Cartan's criterion.

Prerequisite: MATH 528**MATH 534: Lie Theory II**

3 Credits

Representations of compact lie groups and semisimple lie algebras, characters, orthogonality, Peter-Weyl theorem, Cartan-Weyl highest weight theory.

Prerequisite: MATH 533**MATH 535: Linear Algebra and Its Applications**

3 Credits

Vector spaces. Linear transformations. Inner products and quadratic forms. Theory of endomorphisms of a finite-dimensional vector space. Orthogonal bases, spectral theorem and applications.

Prerequisite: MATH 436**MATH 536: Abstract Algebra**

3 Credits

Groups. Sylow's theorems. Rings. Ideals, unique factorization domains. Finitely generated modules. Fields. Algebraic and transcendental field extensions, Galois theory. MATH 536 Abstract Algebra (3) This course covers fundamental concepts, needed toward the study of advanced areas in abstract algebra. The course covers the following topics: groups, Sylow's theorems, rings, ideals, unique factorization domains, finitely generated modules, fields, algebraic and transcendental field extensions, Galois theory.

Prerequisite: MATH 535**MATH 537: Field Theory**

3 Credits

Finite and infinite algebraic extensions; cyclotomic fields; transcendental extensions; bases of transcendence, Luroth's theorem, ordered fields, valuations; formally real fields.

Prerequisite: MATH 536**MATH 538: Commutative Algebra**

3 Credits

Topics selected from Noetherian rings and modules, primary decompositions, Dedekind domains and ideal theory, other special types of commutative rings or fields.

Prerequisite: MATH 536**MATH 547: Algebraic Geometry I**

3 Credits

Affine and projective algebraic varieties; Zariski topology; Hilbert Nullstellensatz; regular functions and maps; birationality; smooth varieties normalization; dimension.

Prerequisite: MATH 536**MATH 548: Algebraic Geometry II**

3 Credits

Topics may include algebraic curves, Riemann-Roch theorem, linear systems and divisors, intersectino theory, schemes, sheaf cohomology, algebraic groups.

Prerequisite: MATH 547**MATH 550: Numerical Linear Algebra**

3 Credits

Solution of linear systems, sparse matrix techniques, linear least squares, singular value decomposition, numerical computation of eigenvalues and eigenvectors.

Prerequisite: MATH 441 or MATH 456

Cross-listed with: CSE 550

MATH 551: Numerical Solution of Ordinary Differential Equations

3 Credits

Methods for initial value and boundary value problems; convergence and stability analysis, automatic error control, stiff systems, boundary value problems.

Prerequisite: MATH 451 or MATH 456

Cross-listed with: CSE 551

MATH 552: Numerical Solution Of Partial Differential Equations

3 Credits

Finite difference methods for elliptic, parabolic, and hyperbolic differential equations; solutions techniques for discretized systems; finite element methods for elliptic problems.

Prerequisite: MATH 402 or MATH 404 ; MATH 451 or MATH 456

Cross-listed with: CSE 552

MATH 553: Introduction to Approximation Theory

3 Credits

Interpolation; remainder theory; approximation of functions; error analysis; orthogonal polynomials; approximation of linear functionals; functional analysis applied to numerical analysis.

Prerequisite: MATH 401 , 3 credits in Computer Science and Engineering

MATH 555: Numerical Optimization Techniques

3 Credits

Unconstrained and constrained optimization methods, linear and quadratic programming, software issues, ellipsoid and Karmarkar's algorithm, global optimization, parallelism in optimization.

Prerequisite: CMPSC456

Cross-listed with: CSE 555

MATH 556: Finite Element Methods

3 Credits

Sobolev spaces, variational formulations of boundary value problems; piecewise polynomial approximation theory, convergence and stability, special methods and applications.

Prerequisite: MATH 502 , MATH 552

Cross-listed with: CSE 556

MATH 557: Mathematical Logic

3 Credits

The predicate calculus; completeness and compactness; Godel's first and second incompleteness theorems; introduction to model theory; introduction to proof theory.

Prerequisite: MATH 435 or MATH 457

MATH 558: Foundations of Mathematics I

3 Credits

Decidability of the real numbers; computability; undecidability of the natural numbers; models of set theory; axiom of choice; continuum hypothesis.

Prerequisite: any 400 level math course

MATH 559: Recursion Theory I

3 Credits

Recursive functions; degrees of unsolvability; hyperarithmetical theory; applications to Borel combinatorics. Computational complexity. Combinatory logic and the Lambda calculus.

Prerequisite: MATH 557 , or MATH 558

MATH 561: Set Theory I

3 Credits

Models of set theory. Inner models, forcing, large cardinals, determinacy. Descriptive set theory. Applications to analysis.

Prerequisite: MATH 557 or MATH 558

MATH 565: Foundations of Mathematics II

3 Credits

Subsystems of second order arithmetic; set existence axioms; reverse mathematics; foundations of analysis and algebra.

Prerequisite: MATH 557 , MATH 558

MATH 567: Number Theory I

3 Credits

Congruences, quadratic residues, arithmetic functions, partitions, classical multiplicative ideal theory, valuations and p-adic numbers; primes in arithmetic progression, distribution of primes.

Prerequisite: MATH 421

MATH 568: Number Theory II

3 Credits

Congruences, quadratic residues, arithmetic functions, partitions, classical multiplicative ideal theory, valuations and p-adic numbers; primes in arithmetic progression, distribution of primes.

Prerequisite: MATH 421

MATH 569: Algebraic Number Theory I

3 Credits

Dedekind rings; cyclotomic and Kummer extensions; valuations; ramification, decomposition, inertial groups; Galois extensions; locally compact groups of number theory.

Prerequisite: MATH 536 , MATH 568

MATH 570: Algebraic Number Theory II

3 Credits

Topics chosen from class field theory; integral quadratic forms; algebraic and arithmetic groups; algebraic function of one variable.

Prerequisite: MATH 569

MATH 571: Analytic Number Theory I

3 Credits

Improvements of the prime number theorem, L-functions and class numbers, asymptotic and arithmetic properties of coefficients of modular forms.

Prerequisite: MATH 421

MATH 572: Analytic Number Theory II

3 Credits

Distribution of primes, analytic number theory in algebraic number fields, transcendental numbers, advanced theory of partitions.

Prerequisite: MATH 571

MATH 573: Partitions

3 Credits

This course provides an overview of theory of partitions. This course focuses on the partition function $p(n)$ and its number theoretic behavior and combinatorial structure, along with related problems. To achieve the main goal, generating function theory, basic hypergeometric series, q -series, and some related combinatorial theory are discussed. Building on these relevant theories, students will be able to understand and prove the arithmetic properties of $p(n)$ and related identities including the Rogers-Ramanujan identities. Students will also be able to recognize and apply the same methods to similar functions and identities.

MATH 574: Topics in Logic and Foundations

3-6 Credits/Maximum of 6

Topics in mathematical logic and the foundations of mathematics.

Prerequisite: MATH 558**MATH 577: Stochastic Systems for Science and Engineering**

3 Credits

The course develops the theory of stochastic processes and linear and nonlinear stochastic differential equations for applications to science and engineering.

Prerequisite: MATH 414 or MATH 418 ; M E 550 or MATH 501

Cross-listed with: ME 577

MATH 578: Theory and Applications of Wavelets

3 Credits

Theory and physical interpretation of continuous and discrete wavelet transforms for applications in different engineering disciplines.

Prerequisite: M E 550 or MATH 501

Cross-listed with: ME 578

MATH 580: Introduction to Applied Mathematics I

3 Credits

A graduate course of fundamental techniques including tensor, ordinary and partial differential equations, and linear transforms.

Prerequisite: Basic knowledge of linear algebra, vector calculus and ODE, MATH 405**MATH 581: Introduction to Applied Mathematics II**

3 Credits

A graduate course of fundamental techniques including Ordinary, Partial, and Stochastic Differential Equations, Wavelet Analysis, and Perturbation Theory.

MATH 582: Introduction to C* Algebra Theory

3 Credits

Basic properties of C* algebras, representation theory, group C* algebras and crossed products, tensor products, nuclearity and exactness.

Prerequisite: MATH 503**MATH 583: Introduction to K-Theory**

3 Credits

K-theory groups for compact spaces and C*-algebras. Long exact sequences, Bott periodicity, index theory and the Pimsner-Voiculescu theorem.

Prerequisite: MATH 503**MATH 584: Introduction to von Neumann Algebras**

3 Credits

Comparison of projections, traces, tensor products, ITPFI factors and crossed products, the Jones index, modular theory, free probability. MATH 584 Introduction to von Neumann Algebras (3) A concise introduction to von Neumann algebra theory, beginning with the basic definitions and proceeding through modular theory. The currently important subjects of index theory and free probability theory will be introduced.

Prerequisite: MATH 503**MATH 585: Topics in Mathematical Modeling**

3 Credits

Introduction to mathematical modeling, covering the basic modeling and common mathematical techniques for problems from physical, biological and social sciences.

Prerequisite: MATH 403 , MATH 411 , and MATH 412**MATH 588: Complexity in Computer Algebra**

3 Credits

Complexity of integer multiplication, polynomial multiplication, fast Fourier transform, division, calculating the greatest common divisor of polynomials.

Cross-Listed

MATH 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

MATH 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

MATH 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

MATH 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

MATH 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

Mathematics Education (MTHED)

MTHED 501: Foundations of Mathematics Education I: Learning

3 Credits

This course focuses on understanding and application of theories of mathematical thinking and learning in research and practice. MTHED 501 Foundations of Mathematics Education I: Learning (3) An understanding of what it means to learn mathematics, knowledge of extant theories of learning mathematics, and knowledge of the nature of students' mathematical thinking at various grade levels are central to the work of mathematics educators. Research, curriculum development, classroom interactions with mathematics students, development of assessments, and many other activities in which mathematics educators engage all draw heavily on understanding and knowledge of mathematical thinking and learning. Students in this course will develop a deeper understanding of classical and contemporary theories of mathematical learning and thinking and comparisons among these theories. Assignments in the course support students' growth in applying these theories to frame research, to enhance instruction, to consider curriculum, to support teacher development, and to effect policy. A major project in the course builds students' skills in investigating mathematical thinking and learning. This course would be one of four required Mathematics Education courses for all doctoral students in the Mathematics Emphasis Area/Curriculum and Instruction Ph.D. program. [The other required courses are MTHED 502 Foundations of Mathematics Education II: Teaching; MTHED 503 Foundations of Mathematics Education III: Curriculum; and MTHED 504 Foundations of Mathematics Education IV: Teacher Development and Policy.] Students in this course would be expected to participate in class discussion, complete weekly assignments, conduct two major projects, and respond to a final examination. Course grades depend on students' performance on all of these measures.

Prerequisite: acceptance in Mathematics Education Emphasis Area/ Curriculum and Instruction Ph.D. program

MTHED 502: Foundations of Mathematics Education II: Teaching

3 Credits

Teaching is the object of study encountered through connections among classical and contemporary theories of teaching and research on teaching. MTHED 502 Foundations of Mathematics Education II: Teaching (3) Teaching mathematics and developing knowledge, skills, and dispositions of mathematics teachers are central tasks in the work of mathematics educators. Thus acquiring deeper theoretical knowledge and practical skills in teaching are fundamental objectives for doctoral students in mathematics education. The focus of this course is on teaching - and not the teacher - as an object of study. In this course, students explore and connect classic and contemporary research and theories of teaching, come to know the nature of mathematics

teaching in tradition and vision, relate theories of teaching to theories of learning, develop ability and disposition to study and improve mathematics teaching and hone ability to evaluate and conduct research on teaching. This course would be one of four required Mathematics Education courses for all doctoral students in the Mathematics Emphasis Area/Curriculum and Instruction Ph.D. program. [The other required courses are MTHED 501 Foundations of Mathematics Education I: Learning; MTHED 503 Foundations of Mathematics Education III: Curriculum; and MTHED 504 Mathematics Education IV: Teacher Development and Policy. This course would typically follow MTHED 501.] Students in this course would be expected to participate in weekly discussions, articulate their emerging philosophies of teaching, and analyze teaching episodes. Course grades depend on students' performance on all of these measures.

Prerequisite: acceptance in Mathematics Education Emphasis Area/ Curriculum and Instruction Ph.D.

MTHED 503: Foundations of Mathematics Education III: Curriculum

3 Credits

Study of mathematics curriculum blends historical trends and current issues with research literature and techniques to study effects of innovations. MTHED 503 Foundations of Mathematics Education III: Curriculum (3) Mathematics educators who are active in leadership of school systems, teacher education, research and development projects, and formulation of education policy are frequently called on for analytic or creative work related to the school and collegiate curriculum. They are asked for advice on the content, organization, presentation, and evaluation of mathematics curricula and the effects of their implementation. Students in this course will develop a connected current and historical view of the nature of K-16 mathematics curriculum materials, movements, and guidelines. They will develop skills and dispositions to critique, conceptualize, design, conduct and report research on curriculum development and implementation efforts. This course would be one of four required Mathematics Education courses for all doctoral students in the Mathematics Emphasis Area/Curriculum and Instruction Ph.D. program. [The other required courses are MTHED 501 Foundations of Mathematics Education I: Learning; MTHED 502 Foundations of Mathematics Education II: Teaching; and MTHED 504 Foundations of Mathematics Education IV: Teacher Development and Policy.] In addition to participation in class discussions, students in this course would be expected to conduct a historical analysis of the treatment of a mathematical theme or topic in K-16 curricula, analyze and synthesize research related to an important issue, analyze instruments used in curriculum research, and propose a research study in some aspect of the mathematics curriculum. Course grades depend on students' performance on all of these measures.

Prerequisite: acceptance in Mathematics Education Emphasis Area/ Curriculum and Instruction Ph.D.

MTHED 504: Foundations of Mathematics IV: Teacher Development and Policy

3 Credits

Nature and study of teacher education and professional development programs and projects coupled with policy and impact in mathematics education. MTHED 504 Foundations of Mathematics IV: Teacher Development and Policy (3) One of the principal day-to-day responsibilities of mathematics educators is teaching of content and

pedagogy courses for prospective teachers. This work often leads to opportunities for leadership through professional development courses and projects with in-service teachers and to consulting work with local, state, and national school, governmental, and professional organizations concerned about educational policy. Effective work in these arenas requires knowledge and practical skills about professional development and institutional change as well as awareness of policies and the role of policy in influencing practice. Students study research and practice in teacher education and professional development of mathematics teachers. They come to know the research and the issues that confront those who prepare teachers and support teachers' continued professional development. Students become familiar with governmental and professional organizations and the critical issues that impact the direction of mathematics education. They also learn how to study local, state, and national policies and publications. This course would be one of four required Mathematics Education courses for all doctoral students in the Mathematics Emphasis Area/Curriculum and Instruction Ph.D. program. [The other required courses are MTHED 501 Foundations of Mathematics Education I: Learning; MTHED 502 Foundations of Mathematics Education II: Teaching; and MTHED 503 Foundations of Mathematics Education III: Curriculum.] In addition to participation in class discussions, students in this course would be expected to articulate a policy regarding a critical issue in mathematics education, evaluate a teacher education or professional development program, propose a professional development or teacher education project, and complete a final examination. Course grades depend on students' performance on all of these measures.

Prerequisite: acceptance in Mathematics Education Emphasis Area/Curriculum and Instruction Ph.D.

MTHED 511: Connections Between Mathematics and Mathematics Education

3 Credits

Course connects college-level mathematics with secondary school mathematics in terms of curriculum content and research on teaching and learning. MTHED 511 Connections Between Mathematics and Mathematics Education (3) The course is organized around key areas of college-level mathematics. In each area, the college-level mathematics focus is on critical ideas, such as fundamental concepts, powerful techniques, and important theorems. These ideas are then explored as abstractions of secondary school mathematics content and as justifications for procedures taught in secondary schools. Resulting new mathematics understandings will be used to understand research on learning and teaching mathematics and to apply research to secondary school mathematics instruction. Mathematics curriculum expectations will include both mathematics content topics and mathematical practices and processes.

Prerequisite: MATH 435 , MATH 471 , MTHED411 , and MTHED427

MTHED 520: Analysis of Research in Mathematics Education

3 Credits

Survey of the status of knowledge about mathematics learning and instruction, K-12; analysis of research procedures; instruments for evaluating research.

Prerequisite: MTHED412W or MTHED420 ; 3 credits in statistics; teaching experience

MTHED 523: Projects in Mathematics Education Research, Curriculum Development, and Evaluation

1-3 Credits/Maximum of 24

Conceptualizing, designing, conducting, and reporting mathematics education research, curriculum development and/or evaluation projects.

Prerequisite: enrollment in Curriculum and Instruction graduate program and by permission of the Mathematics Education emphasis area; course in psychological foundations and course in qualitative or quantitative research foundation

MTHED 527: Research on the Use of Technology in Mathematics Education

3 Credits

Reviewing, critiquing, designing, and conducting research on mathematics learning and teaching in technology intensive environments.

Prerequisite: MTHED427

MTHED 530: Mathematical Thinking at the Secondary and Early College Levels

3 Credits

Exploring and applying theories of advanced mathematical thinking; reviewing, conducting research on mathematical thinking at secondary and early college levels.

Prerequisite: enrollment in Curriculum and Instruction doctoral program with Mathematics Education emphasis; mathematics background equivalent to a Bachelors' degree in mathematics

MTHED 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

MTHED 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

MTHED 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

Mechanical Engineering (ME)

ME 504: Advanced Engineering Thermodynamics

3 Credits

Pure and applied thermodynamics including its application to advanced engineering problems; collateral reading and discussion of the classical works on the subject.

ME 505: Atomistic Scale Simulations for Engineer

3 Credits

This course aims to provide an overview of atomistic-scale methods - in particular, ab-initio based methods like Density Functional Theory and empirical force field methods - to an engineering audience. Due to the increasing availability of computers, atomistic-scale simulation methods are becoming increasingly relevant to engineers, as they can provide key thermodynamic and material properties necessary for the design and analysis of engineering material performance. The main aim of the course is to encourage students to integrate atomistic-scale concepts in their current research. As such, there is a strong emphasis on hands-on experience with various software codes, including commercial codes and academic codes. The students learn the basic concepts of quantum mechanics, statistical thermodynamics, crystallography, physics and chemistry as they relate to ab initio and empirical force field methods and their integration in energy minimization, molecular dynamics and Monte Carlo methods. These concepts are discussed on a conceptual level, enabling students to understand their application range and validity. Furthermore, we dedicate a significant amount of class time to engineer-relevant applications of these force engines and methods.

Cross-listed with: CHE 505

ME 507: Advanced Gas Turbine System and Component Design

3 Credits

Covers fundamental design/analysis theory and modern developments in gas turbine engines used for aircraft propulsion and power generation. Both system-level and component-level considerations will be discussed. Modern computational tools in gas turbine design will be employed on a limited basis to explore system integration effects as well as component-level physics and bring awareness to their usefulness and limitations.

Recommended Preparation: This course will require some foundational knowledge in thermodynamics, fluid dynamics, and heat transfer, as well as ability to use a programming language.

ME 512: Heat Transfer–Conduction

3 Credits

One- and two-dimensional conduction heat transfer for steady state and transient systems with varying boundary conditions.

ME 513: Heat Transfer–Convection

3 Credits

Laminar and turbulent flow heat transfer in natural and forced convection systems.

ME 514: Heat Transfer–Radiation

3 Credits

Thermal radiation fundamentals; specular and diffuse systems; differential and integral methods; numerical techniques; industrial applications.

ME 515: Two-Phase Heat Transfer

3 Credits

Heat transfer processes involving evaporation, boiling, and condensation.

ME 520: Compressible Flow II

3 Credits

Two-dimensional subsonic flow; similarity rules; theory of characteristics; supersonic and hypersonic flows; nonsteady flow; oblique shock waves.

Prerequisite: M E 420

ME 521: Foundations of Fluid Mechanics I

3 Credits

First semester of core sequence in fluid mechanics; Navier-Stokes equations, potential flow, low Re flow, laminar boundary layers.

Prerequisite: M E 300 , M E 320

ME 522: Foundations of Fluid Mechanics II

3 Credits

Second semester of core sequence in fluid mechanics; continuation of boundary layers, stability, transition, turbulence, turbulent boundary layers, turbulence models.

Prerequisite: M E 421 or M E 521

ME 523: Numerical Solutions Applied to Heat Transfer and Fluid Mechanics Problems

3 Credits

Application of finite difference methods to the study of potential and viscous flows and conduction and convection heat transfer.

ME 524: Turbulence and Applications to CFD: DNS and LES

3 Credits

First of two courses: Scalings, decompositions, turbulence equations; scale representations, Direct and Large-Eddy Simulation modeling; pseudo-spectral methods; 3 computer projects.

Prerequisite: AERSP508 or M E 521

Cross-listed with: AERSP 524

ME 525: Turbulence and Applications to CFD: RANS

3 Credits

Second in two courses: Scalings, decomposition, turbulence equations; Reynolds Averaged Navier Stokes (RANS) modeling; phenomenological models; 3 computer projects.

Prerequisite: AERSP508 or M E 521

Cross-listed with: AERSP 525

ME 530: Fundamentals of Combustion

3 Credits

Theoretical formulations and methods of solution of engineering problems and physical/chemical processes in various propulsion systems. ME 530 Fundamentals of Combustion (3) This course is devoted to the fundamentals of chemically reactive flow systems with application to modern jet, rocket, air-breathing engines, and other power generation systems. Experimental and theoretical foundations of steady-state reactions of homogeneous gas mixtures; application of mass and heat diffusion concepts to premixed and non-premixed gaseous flames, liquid-fuel droplet combustion; detonation waves, deflagration-to-detonation transition processes; ignition of gaseous mixtures. Methods for evaluation of thermal and transport properties of gases and liquids will also be discussed. While there are no prerequisites for ME 531, this course serves as a prerequisite for ME 532 (Turbulent and Two-Phase Combustion). The course will: 1) help students acquire a better understanding of the fluid flow, heat transfer, and chemical reaction processes in combustion systems by presenting a systematic description of various analyses developed for describing the fundamental processes involved in chemically reacting flow systems; 2) demonstrate the usefulness of basic principles by performing analyses and obtaining solutions for various combustion problems encountered in engineering so that individuals can utilize them to solve "real-world" problems. 3) provide graduate students with the opportunity to demonstrate their abilities to absorb new materials and to present project results to the class. It is anticipated that, upon completion of this course, students will be able to formulate models for simulating ignition and combustion problems in laminar flow conditions, solve certain types of models, and design laboratory experiments for some diagnostic measurements. Students will be evaluated on the basis of class participation (5%), homework (20%), quizzes (5%), projects (25%), a mid-semester examination (20%) and a final examination (25%). ME 531 will be offered each spring with an anticipated enrollment of 12 students; ME 532 will be offered each fall with an anticipated enrollment of 12.

ME 532: Turbulent and Two-Phase Combustion

3 Credits

Fundamentals of chemically reacting turbulent flows in homogeneous systems including turbulent flames, spray combustion, ignition, reacting boundary layers. M E 532 Turbulent and Two-Phase Combustion (3) M E 532 is the second course of two-course sequence. Continuing where M E 531 (Fundamentals of Combustion) left off, this course is devoted to the fundamentals of chemically reacting turbulent flows in both homogeneous and heterogeneous systems with special emphasis on turbulent flames in gases; heterogeneous combustion; chemical reactions in boundary-layer flows; spray combustion of liquid fuel droplets; two-phase combustion of solid particles; and, ignition of gaseous mixtures and condensed phases. Upon completion of this course, students should be able to: 1) formulate a theoretical model to simulate a combustion problem, based upon knowledge of existing research. 2) identify the major mechanisms involved in a given combustion problem. 3) design a laboratory-scale test apparatus and test matrix to observe combustion phenomena and to take measurements. 4) interpret experimental results in terms of the trend of operating parameters. 5) validate the model using the experimental data and observations. 6) evaluate the merit of a model or experimental design presented in a technical article. 7) analyze realistic combustion problems using the basic principles of combustion and state-of-the-art technology. Students will be evaluated on the basis of homework (20%),

projects (25%), a mid-semester examination (25%), a final examination (25%), and class participation (5%). M E 531 will be offered each spring with an anticipated enrollment of 12 students; M E 532 will be offered each fall with an anticipated enrollment of 12.

Prerequisite: F SC 421 or M E 430 or M E 531**ME 535: Physics of Gases**

3 Credits

An introduction to kinetic theory, statistical mechanics, quantum mechanics, atomic and molecular structure, chemical thermodynamics, and chemical kinetics of gases.

Cross-listed with: AERSP 535

ME 537: Laser Diagnostics for Combustion

3 Credits

A study of laser-based techniques for measuring gas temperature and concentration in chemically reacting flows.

Prerequisite: M E 535**ME 544: Engineering Mathematics**

3 Credits

This course covers ordinary and partial differential equations, linear algebra, numerical methods, special functions, vector calculus, Fourier methods, and complex analysis. These methods will prepare the student for a wide breadth of Mechanical Engineering research and applications in the sub-disciplines of - fluid and thermal sciences, - mechanical sciences, - dynamics, sensors and controls, - transportation systems, - design and manufacturing, - energy systems, and - biomedicine. After successfully completing this course, students will be able to synthesize important elements of Applied Mathematics to research endeavors in Mechanical Engineering. Broadly, they will be able to solve Engineering Mathematics problems using ordinary and partial differential equation methods, vector calculus, linear algebra, numerical methods, spectral methods, special functions, integral transform methods, symbolic mathematics, and complex analysis. The breadth and depth of coverage of ME 544 provides the student with the theoretical framework to synthesize numerous relevant advanced mathematics topics in their research and future scholarly and career activities in Mechanical Engineering. Six of the nine modules in 544 include brief review content introduced at the undergraduate level. 544 significantly extends the breadth and depth of these treatments. Topics not treated at the undergraduate level are incorporated in each module. Applications specific to research activities within Mechanical Engineering are emphasized in lecture examples and assignments.

ME 545: Mechatronics

3 Credits

This class will facilitate the hands-on investigation of mechatronic systems using a problem-based approach, with specific focus on system-level implementations. M E 545 Mechatronics (3) This class will facilitate hands-on investigation and learning of mechatronic systems using a problem-based approach. The course consists of lectures, lab activities, and major projects that train students to develop system-level implementations of mechatronics. This course complements and builds on the existing undergraduate-level microcomputer interfacing course,

which presents model-free design of single-processor, single-sensor, single-task, and/or single actuator mechatronic systems. This course focuses on model-based design of multi-processor, multi-sensor, multi-actuator, and multi-tasking mechatronic systems. Students are expected to be familiar with systems and signals analysis including Laplace transforms, Eigenvalues, Bode plots, stability margins, basic feedback loop performance and stability analysis, etc. Students should have a firm understanding of electrical circuits and structured programming. Nearly all assignments will require the use of MATLAB and/or some C-style programming.

Prerequisite: M E 445

ME 546: Designing Product Families

3 Credits

Product families, product platforms, mass customization, product variety, modularity, commonality, robust design, product architectures. I E (M E) 546 Designing Products Families (3) Designing Product Families is a graduate-level course generally offered in the spring. It is designed for students interested in product realization, engineering design, and manufacturing to gain an understanding of mass customization and methods for designing families of products based on modular and scalable product platforms. The transition from craft production to mass production to mass customization will be covered in this course along with methods and tools for designing robust, modular, and scalable product platforms. Platform leveraging strategies and commonality metrics will be investigated through product dissection activities, which will also be integrated with lectures on evaluating manufacturing and assembly. Several industry case studies will also be discussed in the course to examine the implications of producing a variety of products and strategies for effective mass customization and product postponement. Students interested in taking this course should be familiar with product design and manufacturing. Students are evaluated through individual and group homework assignments, in-class participation and activities, and a group project report and presentation.

Prerequisite: M E 414 or M E 415 or I E 466

Cross-listed with: IE 546

ME 547: Designing for Human Variability

3 Credits

Statistics, optimization, and robust design methodologies to design products and environments that are robust to variability in users.

Cross-listed with: EDSGN 547

ME 550: Foundations of Engineering Systems Analysis

3 Credits

Analytical methods are developed using the vector space approach for solving control and estimation problems; examples from different engineering applications. E E (M E) 550 Foundations of Engineering Systems Analysis (3) This 3-credit course is offered at the first-year graduate level and provides a systems-theoretic background for more advanced graduate courses in the disciplines of engineering and science. The course uses the vector space approach to develop the analytical foundations for solutions of science and engineering problems in diverse application areas such as optimal control, estimation, and signal processing. First, the theoretical foundation of vector spaces, function spaces, and Hilbert spaces are developed. Linear transformations are

then introduced, followed by the Reisz-Frechet theorem and Hahn-Banach theorem, with applications to optimization problems. Spectral analysis is then covered. Finally, diverse applications of these various techniques are presented throughout this course to illustrate the wide range of engineering problems that can be solved using the vector space approach.

Prerequisite: MATH 436

Cross-listed with: EE 550

ME 551: High Power Energy Storage

3 Credits

High-power energy storage technologies including advanced batteries, ultracapacitors, and flywheels. E SC (M E) 551 High Power Energy Storage (3) The course focuses on high-power, in-vehicle energy storage technologies used in hybrid electric vehicles, including advanced batteries, fuel cells, ultracapacitors, and flywheels. An interdisciplinary approach with mechanical, materials, electrical, and chemistry-based concepts provides the foundation to understand the operation and application of these energy storage devices. The course provides a synopsis of hybrid electric and fuel cell vehicle design, control, and simulation to determine the effect of energy storage components on performance and fuel efficiency.

Cross-listed with: ESC 551

ME 552: Optimal Control of Energy Systems

3 Credits

This course provides an overview of the fundamental principles and methods of optimal control, dynamic programming, and extremum-seeking control, with a focus on the application of these tools to a variety of problems in the energy generation, storage, and management domain. Fundamental topics covered include bond graph modeling of energetic systems, constrained and unconstrained static optimization, the Karush-Kuhn-Tucker conditions, extremum-seeking control, the Bellman principle of optimality, deterministic dynamic programming, Markov chains, stochastic dynamic programming, the Bolza optimal control problem, the Pontryagin maximum principle, the Hamilton-Jacobi-Bellman equation, linear quadratic regulation, bang-bang control, and pseudo-spectral optimal control. Applications examined include impedance matching in photovoltaics and wind power plants, fuel-minimizing optimal vehicle path planning, optimal Lithium-ion battery charging/discharging, optimal power management in hybrid electric and hybrid hydraulic vehicles, and optimal building energy management. The course serves as a broad overview of fundamental topics covered in more depth in other classes on dynamic programming, adaptive control, and optimal control. Equal emphasis is placed on the tools and methods of optimal control theory and their practical application to optimal energy management problems. The course is intended for graduate students in engineering interested in energy management research, and already possessing a basic familiarity with energy systems and dynamic system modeling.

Prerequisite: ME 450

ME 554: Digital Process Control

3 Credits

Analysis and design of control systems with digital controllers, including PID, finite settling time, state feedback, and minimum variance algorithms.

Prerequisite: M E 450 , M E 455**ME 555: Linear System Theory and Control**

3 Credits

Advanced problems and techniques in the design of automatic control systems with emphasis on stability, controller design, and optimum performance. M E 555 Linear System Theory and Control (3) This course examines problems and techniques in the analysis and design of linear systems. The course assumes a fundamental background in dynamic system modeling and frequency-domain SISO control input analysis and design. Topics include: vectors and vector spaces; Eigenvalues and Eigenvectors; the Cayley-Hamilton theorem; Jordan canonical forms; internal and BIBO stability; Lyapunov stability analysis; observability and controllability; similarity transformations, state-space realization, and observer/controller canonical forms; pole placement; elementary observer and state-feedback controller design; the separation principle; Kalman filtering; and linear quadratic regulation.

Prerequisite: M E 455**ME 556: Robotic Concepts**

3 Credits

Analysis of robotic systems; end effectors, vision systems, sensors, stability and control, off-line programming, simulation of robotic systems.

Prerequisite: I E 456 or M E 456**ME 558: Robust Control Theory**

3 Credits

Fundamentals of Robust Control Theory with emphasis on stability, performance analysis, and design.

Prerequisite: E E 580 or M E 555

Cross-listed with: EE 584

ME 559: Nonlinear Control and Stability

3 Credits

Design of nonlinear automatic control systems; phase-plane methods; describing functions; optimum switched systems; Liapunov stability; special topics in stability.

Prerequisite: E E 380

Cross-listed with: EE 587

ME 560: Solid Mechanics

3 Credits

Introduction to continuum mechanics, variational methods, and finite element formulations; application to bars, beams, cylinders, disks, and plates. E MCH (M E 560) 500 Solid Mechanics (3) This course introduces students to the fundamental principles and basic methods used in solid

mechanics. Using indicial notation and integral formulations provides a foundation for more advanced study in continuum mechanics (E MCH 540) and finite element analysis (E MCH 560) specifically and in mechanics in general. The materials behavior is restricted to linear elastic and the emphasis is on stress analysis. Students are expected to have an understanding of elementary mechanics of materials (such as E MCH 013). The course objectives are to: 1) provide students with a firm foundation in solid mechanics. 2) introduce continuum mechanics concepts, variational methods, and the formulation used in finite element analysis. 3) enable students to formulate and solve the boundary value problems commonly encountered in the analysis of structures. The study of solid mechanics starts with the definition of stress and strain and how the two are related by material law. Field equations that relate strain to displacement, ensure a single valued displacement field, and the balance momentum are formulated. These are partial differential equations that can only be solved subject to known boundary and initial conditions. The field equations and boundary conditions comprise a boundary value problem that is usually difficult to solve exactly. Variational methods are used to bound or approximate the solution. The finite element method employs variational methods to formulate generic elements and is a computational tool for solving boundary value problems for complex geometries.

Cross-listed with: EMCH 500

ME 561: Structural Optimization Using Variational and Numerical Methods

3 Credits

Shape and size optimization of elastic structures, continuous and discrete solution methods and numerical algorithms, design of compliant mechanisms. ME 561 Structural Optimization Using Variational and Numerical Methods (3) Optimal Structural Design is a graduate-level course generally offered in spring semester. The course is designed for graduate students in mechanical engineering or related fields who have already taken a course in finite element analysis. The course covers techniques in structural optimization from classical variational-based methods to modern numerical and finite element-based methods. Topics include shape and size optimization of elastic structures, continuous and discrete methods for least weight maximum stiffness design, solution using optimality criteria methods, structural topology optimization, gradient-based solution methods and numerical algorithms, and design project(s) using these methods. Methods are applied to examples such as beam and truss structures, compliant mechanisms, and piezoelectric actuators. Computer programming skills using software such as Matlab are required. Students are evaluated based on homework assignments, review and presentation of articles from the literature, class participation, and a group design project.

Prerequisite: M E 461**ME 563: Nonlinear Finite Elements**

3 Credits

Advanced theory of semidiscrete formulations for continua and structures; emphasizes dynamic and nonlinear problems.

Prerequisite: A B E513 , E MCH461 , or E MCH560

Cross-listed with: EMCH 563

ME 564: Elastic and Dynamic Stability of Structures

3 Credits

An introduction to the concept and analysis methods of structural stability; structures under static/dynamic loading and high speed conditions.

Prerequisite: E MCH213 , M E 450 ; students need to have basic understanding of mechanical behavior of materials to follow the equations in this course, and basic concepts of system stability to expand them to elastic structures

ME 565: Optimal Design of Mechanical and Structural Systems

3 Credits

Application of numerical optimization techniques to design mechanical and structural systems; design sensitivity analysis.

ME 566: Metal Additive Manufacturing Laboratory

3 Credits

This course will provide in-depth and hands-on laboratory experience in metal-based additive manufacturing. The laboratory activities will expose students to all aspects of the additive manufacturing workflow for metal components, starting with conceptual design, proceeding through fabrication, post-processing, and part inspection. Laboratory activities will include part design and analysis, process simulation and modeling, build preparation and machine set up, fabrication and post-processing, and non-destructive inspection and measurement. Laboratories will include computational design tools and simulation models as well as fabrication and post-processing (e.g., heat treatment, machining). Finally, the laboratory activities will also stress safe powder handling, equipment, and laser safety, which is particularly important when working with metallic powders and feedstocks. The laboratory is intended for students that have a basic understanding of the different additive manufacturing processes and are gaining familiarity with the engineering and science of additive manufacturing. The laboratory activities will provide students with the scientific foundation and research skills necessary to rigorously ascertain the performance of additively manufacturing materials, processes, and parts. Upon completion of the laboratory, students should be able to describe the workflow for additive manufacturing, identify main cost drivers, and describe the differences when using metals versus polymers. They should also understand the key tradeoffs between design, manufacturing, and materials as it relates to the additive manufacturing processes utilized in the laboratory activities.

Recommended Preparation: This course is intended for students that have a basic understanding of the different additive manufacturing processes and are interested in gaining familiarity with the engineering and science of additive manufacturing

Cross-listed with: AMD 566

ME 571: Foundations of Structural Dynamics and Vibration

3 Credits

Modeling approaches and analysis methods of structural dynamics and vibration.

Prerequisite: AERSP304 , E MCH470 , M E 450 , or M E 570

Cross-listed with: AERSP 571, EMCH 571

ME 577: Stochastic Systems for Science and Engineering

3 Credits

The course develops the theory of stochastic processes and linear and nonlinear stochastic differential equations for applications to science and engineering.

Prerequisite: MATH 414 or MATH 418 ; M E 550 or MATH 501

Cross-listed with: MATH 577

ME 578: Theory and Applications of Wavelets

3 Credits

Theory and physical interpretation of continuous and discrete wavelet transforms for applications in different engineering disciplines.

Prerequisite: M E 550 or MATH 501

Cross-listed with: MATH 578

ME 581: Simulation Multibody Dynamics

3 Credits

This course addresses kinematic and dynamic analyses of planar and spatial constrained multibody systems. The first half addresses planar methods while the second half is devoted to extensions for spatial analyses. Kinematic mobility and topology are introduced to help students recognize joint constraints within kinematic chains embedded in larger systems. Joint constraint models using matrix methods are formulated to describe kinematically driven chains. Systemic differential-algebraic equations are then derived that can be used for both inverse dynamics and forward dynamic time integration. Numerical integration methods for time domain simulation are also discussed. Overall goals are for students to be able to identify forward versus inverse dynamic problems; program their own planar and spatial kinematic models; and simulate forward dynamics.

Recommended Preparations: Advanced mathematical or computational experience

ME 590: Colloquium

1 Credits

Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

ME 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

ME 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

ME 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

ME 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

ME 602: Suprvised Experience in College Teaching

1-3 Credits/Maximum of 6

For graduate students helping to teach the beginning thermodynamics course, M.E. 22. Must have taken M.E. 504.

ME 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No Description.

ME 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

Meteorology (METEO)

METEO 511: The Weather From Global to Micro Scales

3 Credits

Conceptual models and underlying physics for weather phenomena on scales from the global general circulation to turbulence. METEO 511 The Weather From Global to Micro Scales (3) Earth's weather occurs on a variety of scales from the global general circulation down to microscale turbulence. This spectrum includes synoptic scale storms whose structure and dynamics vary with latitude and topography as well as a broad range of mesoscale phenomena whose structure depends strongly on the vertical structure of the atmosphere. At these intermediate scales, each phenomenon draws energy from conditions created by phenomena of both larger and smaller scale phenomena. Thus, the full spectrum of weather phenomena is linked energetically. This course explores these linkages and the dynamics of the weather phenomena that result. Quantitative results from this theoretical analysis are then used to explain the structure and behavior of the phenomena themselves. Using both theoretical and observational methods students will gain an understanding of the full spectrum of weather phenomena including the physics and dynamics responsible for their structure, development, and evolution.

Prerequisite: METEO520 , METEO521 , METEO531

METEO 512: Topics in Synoptic Meteorology

3 Credits

Application of atmospheric dynamics to the diagnosis and prediction of synoptic-scale weather. The primary objective of the course is to investigate midlatitude synoptic-scale weather systems from a quasigeostrophic perspective. Topics include Sutcliffe's development theorem, quasigeostrophic height tendency and omega equations,

midlatitude extratropical cyclones, fronts and frontogenesis, semigeostrophic theory, and the potential vorticity perspective of synoptic-scale analysis. The course builds upon the dynamical understanding acquired in atmospheric dynamics and synoptic meteorology courses, and is well-suited for students seeking careers in a broad range of areas, including but not limited to air quality, weather forecasting and communications, microscale meteorology, mesoscale meteorology, and synoptic meteorology.

Prerequisite: METEO 411

METEO 515: PRACTICAL STATISTICS FOR ATMOSPHERIC SCIENCES

3 Credits

The aim of this course is to build practical statistical tools for data analysis in the atmospheric sciences. The course will first provide the students with a solid foundation in fundamental statistical concepts, including hypothesis testing, maximum likelihood estimation, random variables, and probability density functions. Once the students are familiar with the basic terminology and concepts in statistics, the course will move on to a suite of more advanced statistical techniques that are commonly used in atmospheric science research. The advanced topics include regression analysis, nonparametric tests and resampling techniques, data reduction such as eigendecompositions and principal component analysis, time series analysis, spatial statistics, and Bayesian modeling. The emphasis will be on the sound application of these techniques and their interpretations, rather than technical foundations and derivations. The goal is to build intuition behind commonly used statistical tools and learn how to avoid potential pitfalls in their applications.

RECOMMENDED PREPARATIONS: The course assumes familiarity with calculus and linear algebra, including basic matrix manipulations and eigendecomposition.

METEO 520: Geophysical Fluid Dynamics

3 Credits

Fundamentals of fluid dynamics with an emphasis on basic concepts that are important for atmospheric and oceanic flows. METEO 520 Geophysical Fluid Dynamics (3) This is a course in the fundamentals of fluid dynamics with an emphasis on basic concepts that are important for geophysical flows, such as those in the atmosphere and ocean. Topics include kinematics, conservation laws, vorticity dynamics, dynamic similarity, laminar flows, and an introduction to waves and instability. Students should leave this course with a solid foundation in fluid dynamics, possessing a conceptual and mathematically rigorous understanding of the fundamental conservation laws for fluids and some basic applications of them. Together, METEO 520 and METEO 521 (Dynamic Meteorology) make up the core dynamics curriculum for graduate students of meteorology.

Prerequisite: Vector calculus, differential equations

METEO 521: Dynamic Meteorology

3 Credits

An overview of the major large-scale atmospheric motions of weather and climate.

Prerequisite: METEO520

METEO 523: Modeling the Climate System

3 Credits

An introduction to the mathematical description and modeling of atmospheric and oceanic motions.

METEO 526: Numerical Weather Prediction

3 Credits

Finite difference and spectral methods, barotropic and baroclinic models, filtered and primitive equation models, synoptic-scale and mesoscale models.

Prerequisite: METEO422 or METEO522

METEO 527: Data Assimilation

3 Credits

Data assimilation (DA) is the process of finding the best estimate of the state and associated uncertainty by combining all available information including model forecasts and observations and their respective uncertainties. DA is best known for producing accurate initial conditions for numerical weather prediction (NWP) models, but has been recently adopted for state and parameter estimation for a wide range of dynamical systems across many disciplines such as ocean, land, water, air quality, climate, ecosystem, and astrophysics. Taking advantages of improved observing networks, better forecast models, and high performing computing, there are two leading types of advanced approaches, namely variational data assimilation through minimization of a cost function, or ensemble-based data assimilation through a Kalman filter. Hybrid techniques, parameter estimation, predictability, and ensemble sensitivity methods will also be covered. Emphasis will be on applications to atmospheric science and numerical weather prediction, and the unique aspects of its observing systems, computer models, and predictability characteristics. The material in this course may be relevant to those in engineering, statistics, mathematics, hydrology, earth systems science, atmospheric science, and many other fields that seek to integrate information from observations and models.

RECOMMENDED PREPARATIONS: A basic knowledge of probability theory, statistics, calculus, linear algebra/matrices, and computer programming is expected.

METEO 528: Parameterization Schemes

3 Credits

Parameterization is the process by which important physical processes that cannot be resolved explicitly in a numerical model are represented. Examples include the transfer of shortwave radiation through the atmosphere, and the formation of cloud droplets, both of which occur on the molecular scale. As numerical models have grid spacing of hundreds of meters, molecular processes are not resolved explicitly in current models and so must be parameterized. A parameterization scheme is a representation of our understanding of the physical process as related to the available model variables, such that one can estimate how the behaviors of these important sub-grid physical processes influence the available model variables. In this way, sub-grid scale physical processes are included in models even when they cannot be explicitly represented. The most common parameterization schemes used in numerical models of the atmosphere will be discussed, including land and ocean surface, planetary boundary layer, convection, microphysics, radiation, cloud cover,

and orographic drag. Emphasis is placed upon understanding the basic approaches to parameterization and how the differences in approaches influence the resulting behaviors.

Recommended Preparations: A general, broad knowledge of meteorology and atmospheric science, as well as experience in computer programming.

METEO 529: Mesoscale Dynamics

3 Credits

A survey of concepts of mesoscale systems including frontogenesis, symmetric instability, mountain waves, wave CISK, and frontal waves.

Prerequisite: METEO521

METEO 531: Atmospheric Thermal Physics

3 Credits

Advanced treatment of thermodynamic principles as they relate to atmospheric cloud physics, radiation and dynamics. METEO 531 Atmospheric Thermal Physics (3) Thermal physics concepts are important to understanding many facets of atmospheric cloud physics, radiation and dynamics. This course presents a rigorous treatment of these concepts as they appear in the atmospheric sciences.

METEO 532: Chemistry of the Atmosphere

3 Credits

Review of chemical principles in gaseous and multiphase environments; characteristics of key atmospheric components and chemical systems in the lower and middle atmosphere.

Prerequisite: CHEM 110

METEO 533: Cloud Physics

3 Credits

Overview of cloud systems; theories of phase changes in clouds and micro-physical mechanisms of precipitation formation; cloud electrification.

Prerequisite: METEO431

METEO 535: Radiative Transfer

3 Credits

Fundamentals of electromagnetic radiation and its interaction with matter; radiation and climate, atmospheric remote sensing, and observable atmospheric optical phenomena.

METEO 538: Atmospheric Convection

3 Credits

Properties of shallow and deep atmospheric convection and interactions between convection, the boundary layer, and larger-scale weather systems.

METEO 551: Physical Oceanography

3 Credits

This course provides graduate and advanced undergraduate students in the sciences and engineering an overview of the circulation of the ocean and the theories used to explain it. The focus is on the large-scale circulation driven by winds, buoyancy, and tidal forces. The course will also cover the distributions of temperature and salinity in the ocean, the surface ocean mixed layer, mesoscale eddies, and internal waves.

METEO 554: Atmospheric Turbulence

3 Credits

An introduction to the physics, structure, modeling, representation, and measurement of atmospheric turbulence.

Prerequisite: METEO520

METEO 556: The Atmospheric Boundary Layer

3 Credits

The atmospheric boundary layer is the layer of the atmosphere that is in frequent contact with the surface of the earth. It is the layer where life exists, and which mediates exchanges of energy, momentum, and chemicals between the earth's surface and the atmosphere. The scales of motion in the atmospheric boundary layer, because of the presence of the earth's surface, are small compared to the rest of the atmosphere. The dynamics, therefore, differ from those found in the 'free' atmosphere. This course describes the physical properties of the layer of the earth's atmosphere that is in frequent contact with the earth's surface, the atmospheric boundary layer. The course includes a descriptive overview of this layer using observations, then presents the governing equations and common simplifications used to describe the boundary layer. Conservation of mass, energy, and momentum, are covered. A core principle is the decomposition of the governing equations into a mean state and turbulent components, and the challenges introduced by this decomposition. The concepts of eddy diffusivity and closure methods are motivated by this challenge. These principles and governing equations are used to understand the typical evolution of the atmospheric boundary layer as a function of time of day. Convective and stable boundary layer conditions are contrasted. The contrasting conditions are linked to changes in the exchange of energy, momentum and water vapor at the earth's surface. The fundamentals of plume dispersion are described and tested. A simple numerical model of the atmospheric boundary layer is discussed and applied to atmospheric data. Stability conditions in the atmosphere are further explored using the equation for turbulent kinetic energy. Parameters describing the turbulence state of the surface layer and boundary layer, including the Obukhov length, friction velocity, convective velocity scale, and Richardson number, are discussed and applied to typical boundary layer conditions and observations. Similarity theory is discussed as a means of describing turbulent properties of the atmospheric boundary layer as a function of stability conditions. Monin-Obukhov similarity theory for the surface layer is applied to atmospheric observations. Additional common atmospheric boundary layer states are described, including cloud topped boundary layers, marine boundary layers, and boundary layers in heterogeneous terrain. Observational, measurement and numerical methods are presented and used in class assignments.

METEO 560: Weather, Climate, and Society

3 Credits

Successful science communication is critical to all aspects of meteorology, including research, operations, broadcast, and private industry, though scientific literature reveals the wide range of challenges to successful science communication. In this course, students learn primary modes of communication employed by atmospheric scientists, with emphasis on deterministic and probabilistic weather forecasts, global and regional climate projections, and examine their effectiveness. The course builds on this foundation to evaluate the institutional, social, behavioral, political, economic barriers to successful atmospheric science communication and quantify the impact of these challenges on scientific advancements and public responsiveness. Students will learn fundamentals in cognitive versus emotional empathy, communicative responsiveness, prosocial behavior, apply these concepts to the atmospheric sciences, and make inferences about how an individual's or society's perspective impacts decision making behavior.

METEO 561: The Global Carbon Cycle

3 Credits

This course focuses on one of the most challenging environmental issues of our era, the accumulation of carbon dioxide (CO₂) and methane (CH₄) in our atmosphere due to human modification of the global carbon cycle. We will study the processes, terrestrial, oceanic, atmospheric, and anthropogenic, that govern the sources and sinks of carbon into and out of the global atmosphere, and will study the methods used to quantify the carbon cycle. The primary focus is on the recent past (industrial era) and near-future (~100 years), when carbon cycle management decisions will play a critical role in climate change. The course starts with a review of global atmospheric CO₂ and CH₄ trends during the industrial era, and examines how atmospheric data inform our understanding of the global carbon cycle. The course then studies contemporary terrestrial biosphere, marine, and anthropogenic processes governing the carbon cycle. The paleorecord of the carbon cycle is reviewed, including glacial / interglacial cycles. Carbon cycle predictions and projections, including options for human management of the carbon cycle, are presented and evaluated. Ethical and economic factors, in addition to physical and biological processes, are considered. The course is appropriate for graduate students or advanced undergraduates with a sound background in quantitative sciences or engineering. The course is suitable for students from a wide variety of degree programs across the university.

METEO 563: Bioclimatology

3 Credits

Climatic phenomena in their relation to life.

METEO 570: Climate System Dynamics

3 Credits

Climate Dynamics delves into the fundamental processes that control the earth's climate of the past, present, and future. Fundamentals are developed from concepts of basic dynamic meteorology, radiative transfer, and thermodynamics. The surface energy and hydrologic budgets, and the atmospheric and oceanic circulation are covered. The cryosphere and its interactions with the atmosphere are also discussed. A survey of the earth's climate through geologic history is also explored. The concepts developed in this course are applied to the topic of

anthropogenic climate change and how various aspects of the climate system could be influenced by global mean, long-term warming.

METEO 575: Climate Dynamics Seminar

1-3 Credits/Maximum of 15

Review of evolving climate dynamics and earth system science, including ongoing departmental research.

METEO 582: Ice and Snow Physics

1-3 Credits/Maximum of 15

Structure of ice and its electrical, optical, mechanical, and surface properties; snow formation in the atmosphere.

METEO 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

METEO 591: Development and Ethics in the Atmospheric Sciences

1 Credits

Provide a forum for discussion of scholarship and research integrity as well as critical components of professional development. METEO 591 Development and Ethics in the Atmospheric Sciences (1) This course provides a forum with graduate faculty for discussions on responsible conduct of research topics relevant to the atmospheric sciences, including, but not limited to: acquisition, management, sharing, and ownership of data; publication practices and responsible authorship; conflict of interest and commitment; research misconduct; peer review; mentor/trainee responsibilities; collaborative science. Important components to successful professional development of students are also considered.

METEO 592: Research Proposal Preparation in the Atmospheric Sciences

1 Credits

This course familiarizes graduate students with research rigor, proposals, and processes. METEO 592 Research Proposal Preparation in the Atmospheric Sciences (1) This course familiarizes graduate students with research rigor, proposals, and processes. The focus of these topics is upon research proposal preparation, research literature surveys, preparing a research proposal, and verbally defending the written research proposal in an oral presentation type setting.

METEO 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

METEO 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

METEO 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

METEO 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

METEO 602: Supervised Experiences in College Teaching

1-3 Credits/Maximum of 6

No description.

METEO 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

METEO 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

METEO 801: Understanding Weather Forecasting for Educators

3 Credits

Fundamental principles of synoptic and physical meteorology, remote sensing and data analysis in the setting of mid-latitude weather forecasting. METEO 801 Understanding Weather Forecasting for Educators (3) Never before has the quantity of available weather information so far exceeded the quality of the public's understanding of atmospheric science. METEO 801 aims to help correct this imbalance by helping secondary teachers to develop the knowledge and skills they need to become critical consumers of weather information and to, in turn, help their own students to do the same. Students who successfully complete METEO 801 will be able to apply knowledge of fundamental concepts of atmospheric science to discriminate between reliable and unreliable weather forecasts, to explain what makes one forecast better than another, and to teach these same concepts and applications to secondary school students. To ensure that students develop the knowledge and skills required to critically assess public weather forecasts, METEO 801 will provide an apprentice-training environment that will encourage students to learn forecast mid-latitude weather themselves. They will discover that weather forecasting involves sophisticated data analysis techniques, a thorough understanding of atmospheric science, and strong verbal and graphic communication skills. METEO 801 will combine digital video, audio, simulation models, virtual field trips to on-line weather data resources, text, and interactive quizzes that provide instantaneous feedback. The course will provide unprecedented access to one of the world's most distinguished meteorology programs. METEO 801 students will be granted licenses to use the courseware developed for this course in their own secondary classrooms. The overarching goal of the course is to help secondary science teachers become informed, critical consumers of the weather information they rely upon every day and to be able to effectively convey their knowledge to their students as part of an Earth science curriculum. Students will be required to complete weekly assignments. There are 12 lessons in METEO 801. Each lesson contains interactive exercises,

links, animations, movies, and novel explanations of the basic scientific principles of how the atmosphere works. At the end of each Lesson, students will take an open-book "Promotion Quiz" that allows them to improve their status as an apprentice forecaster. In addition to Promotion Quizzes and weekly assignments on the course discussion board, students will be assigned four projects throughout the semester. Projects are also open book but require you to apply the principles students have learned to past case studies of storms and specific weather patterns.

METE0 802: Fundamentals of Tropical Forecasting for Educators

3 Credits

Applying atmospheric principles to the tropics, with an emphasis on the development, structure, prediction, and destructive impact of hurricanes. METE0 802 Fundamentals of Tropical Forecasting for Educators (3) Worldwide, approximately 80 tropical cyclones develop each year. This global annual average of tropical cyclones is small in comparison to the thousands of low-pressure systems that routinely parade across the middle latitudes each year. Yet tropical storms and hurricanes garner far greater attention from meteorologists and the media. The obvious reason for this lopsided focus is that tropical cyclones can inflict great devastation to life and property. To ensure that students develop the knowledge and skills required to critically assess weather forecasts issues by the National Hurricane Center, METE0 802 provides, like METE0 801, an apprentice-training environment. Under the tutelage of professional weather forecasters, students, in their role as apprentices, work toward the goal of creating their own tropical-weather forecasts. In the process, students in METE0 802 learn about the pitfalls of forecasting the tracks and intensities of tropical storms and hurricanes as they actively work with output from sophisticated numerical models available on the Internet. Moreover, successful students apply their knowledge of the fundamental concepts of atmospheric science in order to competently evaluate forecasts issues by the National Hurricane Center in Miami and the Joint Typhoon Warning Center in Honolulu. Students also gain a broad perspective of the general weather and oceanic patterns in the tropics. For example, students learn about El Nino and La Nina. In the process, they discover the El Nino and La Nina are not to blame for every unusual weather even that occurs anywhere in the world. To facilitate the learning objectives, METE0 802 includes the use of digital video, audio, simulation models, virtual field trips to on-line resources for weather data, text, and interactive quizzes that provide timely feedback. The course will provide unprecedented access to one of the world's most distinguished meteorology programs. METE0 802 students will be granted licenses to use the courseware developed for this course in their own secondary classrooms. One of the primary objectives of METE0 802 is to give secondary science teachers a working knowledge of hurricanes and tropical storms so that they can become critical weather consumers and to be able to effectively convey their knowledge to their students as part of an Earth science curriculum. Students will be required to complete weekly assignments. There are 12 lessons in METE0 802. Each lesson contains interactive exercises, links, animations, movies, and novel explanations of the basic scientific principles of how the atmosphere works. To demonstrate their mastery of the learning objectives, students complete automated online quizzes actively engage in online discussion groups focusing on real-time weather, and publish, to a person "e-portfolio," three comprehensive projects that explore timely case studies related to weather forecasting. The e-portfolio takes the form of a Web site. In addition to posting their work to their e-portfolio, students also use the space to reflect on their learning. By using their Penn State personal Web space to host their e-portfolios, students are able to share their work not only with program

faculty and students, but also with external audiences, including potential employers.

Prerequisite: METE0801

METE0 803: Fundamentals of Mesoscale Weather Forecasting for Educators

3 Credits

Applying atmospheric principles to small-scale weather systems, with an emphasis on the conceptual modeling and short-range prediction of severe thunderstorms. METE0 803 Fundamentals of Mesoscale Weather Forecasting for Educators (3) When outbreaks of severe weather occur, dire warnings for tornadoes, large hail or damaging straight-line winds urgently scroll across the bottoms of television screens. Simultaneously, television weathercaster's warn viewers to "take cover immediately." Yet, because of the limited spatial and time scales of severe thunderstorms, the areas affected by tornadoes, large hail and damaging straight-line winds often turns out to be relatively small (sometimes as small as a tenth of one percent of the original "watch area"). There is no doubt that people should be prepared to take definitive action to protect their lives and the lives of their families when outbreaks of severe weather occur. But the overall impression that entire counties or cities will be destroyed by severe weather can be, and frequently is, misleading. To ensure that students develop the knowledge and skills required to critically assess public weather forecasts, METE0 803 provides an apprentice training environment that guides students, under the tutelage of professional weather forecasters, to actively learn how to create their own mesoscale-weather forecasts. In the process, METE0 803 reinforces the notion that weather forecasting involves sophisticated techniques of data analysis and a thorough understanding of atmospheric science. METE0 803 also stresses that the clear communication of the forecast requires strong verbal and graphic communication skills. Using conceptual models and real-time radar and satellite imagery in concert with output from numerical models designed specifically for mesoscale forecasting, students predict severe weather on time scales of a few hours to one day. For example, students are required to choose a tornado "watch-box" issued by the Storm Prediction Center (SPC) in Norman, Oklahoma, and then to evaluate the forecast (and forecast verification) in the setting of a litany of scientifically sophisticated tools on SPC's Web site. In effect, students will mirror the process that professional forecasters follow to create such high-profile forecasts. For more general outlooks that identify regions where there is a potential for severe weather (time scales of one to two days), students will use output from the numerical models that were introduced in METE0 801 to identify the areas likely to be at risk for severe weather. To facilitate the learning objectives, METE0 803 includes the use of digital video, audio, simulation models, virtual field trips to on-line resources for weather data, text, and interactive quizzes that provide timely feedback. The course will provide unprecedented access to one of the world's most distinguished meteorology programs. METE0 803 students will be granted licenses to use the courseware developed for this course in their own secondary classrooms. One of the primary goals of METE0 803 is to give secondary science teachers a scientifically grounded perspective of the spatial and time scales of typical outbreaks of severe weather and other events associated with mesoscale weather systems. In the process, students become better weather consumers and to be able to effectively convey their knowledge to their students as part of an Earth science curriculum. To gain such insights, students learn conceptual models of the life cycles of severe thunderstorms and then apply them in real-time outbreaks of severe weather. In the final analysis, students are able to more accurately weigh the information being disseminated by the media and the Storm Prediction Center in Norman,

Oklahoma. Students will be required to complete weekly assignments. There are 8 lessons in METEO 803. Each lesson contains interactive exercises, links, animations, movies, and novel explanations of the basic scientific principles of how the atmosphere works. To demonstrate their mastery of the learning objectives, students complete automated online quizzes, actively engage in online discussion groups focusing on real-time weather, and publish, to a personal "e-portfolio," three comprehensive projects that explore timely case studies related to mesoscale weather forecasting. The e-portfolio takes the form of a Web site. In addition to posting their work to their e-portfolio, students also use the space to reflect on their learning. By using their Penn State personal Web space to host their e-portfolios, students are able to share their work not only with program faculty and students, but also with external audiences, including potential employers.

Prerequisite: METEO801

METEO 810: Weather and Climate Datasets

3 Credits

Anticipating weather events first requires an understanding of typical (or expected) conditions at a particular site. Such climatologies are constructed primarily from historical observations but may also include numerically derived forecasts and analyses. In this course, students will learn a variety of methods for accessing appropriate weather and climate datasets available from government and research institutions. Working with very large datasets in a computationally efficient manner will be stressed, as will consideration of factors that affect data reliability. Students will be encouraged to consider numerous possibilities for presenting weather and climate data with a minimum of quantitative analysis. In addition, numerous examples and case studies will augment discussions on such topics as numerical reanalysis datasets, self-describing archives, and typical problems encountered with environmental observations. Finally, students will learn to construct a site-specific or regional climatology and to communicate a qualitative analysis of those data to others.

RECOMMENDED PREPARATIONS: Coursework and/or experience with basic computer programming

METEO 815: Applied Atmospheric Data Analysis

3 Credits

This course provides practical guidance in the quantitative analysis of large weather and climate datasets for incorporation into a data analytics system. Students will learn a variety of methods for describing environmental data focusing on bulk characteristics, hypotheses testing, linear modeling, and variability modeling. Furthermore, current data mining strategies used in creating analysis workflows will be presented. Specific emphasis will be placed on data organization and pre-processing for computational analysis, validating assumptions for a particular analysis technique, identification and resolution of non-compliant data sets, and use of analysis/display software to improve communication of results. Numerous examples and case studies will augment discussion on the various analysis methods with the goal being to broaden the student's perspective on the use of weather and climate data in decision-making.

Prerequisite: METEO 810

METEO 820: Time Series Analytics for Meteorological Data

3 Credits

This course provides practical guidance in the quantitative analysis of large weather and climate time series datasets for incorporation into an analytical modeling system. Students will learn a variety of methods for identifying key temporal patterns in atmospheric datasets, modeling methods based on patterns, trend analyses in climate datasets, advanced modeling methods, frequency domain analyses, and spatial-temporal visualization techniques specific to meteorology. Furthermore, data reduction techniques will be discussed for working with big weather and climate datasets. Specific emphasis will be placed on preparing environmental data for analysis, data visualization techniques, correctly selecting appropriate analyses, validating results, and realistic interpretations of results. Case studies will augment the discussion on the various time series methods with the goal being to broaden the student's perspective on the use of weather and climate data for forecasting and modeling as it pertains to decision making.

Prerequisite: METEO 810, METEO 815

METEO 825: Predictive Analytic Techniques for Meteorological Data

3 Credits

This course provides practical guidance in forecast systems of weather and climate variables for incorporation into decision-making systems. Students will learn a variety of methods for prognostic modeling of categorical and continuous variables, measuring forecast accuracy, and assessing results through Monte Carlo simulations. Ensemble environmental forecasting techniques will also be presented. Specific emphasis will be placed on the strengths and limitations of each technique, validating assumptions for particular forecast methods, and assessing the results of the weather or climate model using a variety of statistical techniques. Numerous examples and case studies will augment discussion of the techniques with the goal being to grow the student's knowledge on weather and climate forecasting and its usage in decision-making.

Prerequisite: METEO 820

METEO 830: Weather and Climate Analytics Applications

1 Credits

The goal of weather and climate analytics is to better inform decision-makers on the probability of adverse and advantageous weather events. This course will adopt a case study approach whereby students learn to create a weather and climate analytics analysis and presentation. Emphasis will be placed on framing a problem with appropriate research, collecting and analyzing historical data, developing appropriate analytical modeling, and presenting results and recommendations. As preparation for synthesizing their own project, students will scrutinize multiple examples of weather and climate analytic studies from a variety of industries and sectors. Furthermore, the course will provide multiple opportunities for students to receive guidance and feedback from their instructor, fellow classmates, and industry professionals.

Prerequisite: METEO 825

METEO 880: Communication of Research in Atmospheric Science

2 Credits

In this course, students will learn how to present the results of their research in the three main forms that atmospheric scientists currently use: peer-reviewed journal articles, poster presentations, and oral presentations. Students will learn how scientific writing differs from other forms of writing and will learn the building blocks for constructing effective paragraphs and sentences for journal articles. The structure of a journal article will be described and students will learn about each of the key elements of a journal article, including the abstract, introduction, methods, results, discussion, conclusions, references, figures, and tables. Authorship and the peer-review process will be discussed. Finally, students will learn techniques for communicating their research to the general public.

METEO 891: Professional Development for Graduate Students

1 Credits

The one-credit pass/fail course will offer practical and helpful advice to graduate students who are ready to begin exploring career opportunities. The course will cover professionalism and ethics, writing and reviewing scientific papers, how to succeed at grant writing, post-doctoral opportunities and examples, careers in industry, careers in government and academic, the job application process, how to interview, career planning after college, financial literacy, the value of professional societies for your career, dealing with new media, and leadership development. There will be guest speakers, including successful alumni, university staff, and others whose participation will enhance the value of the class. Finally, students will be paired with an alum in a similar or related discipline and will interview this alum about their career and any advice they would offer a recent graduate. The students will share what they learned during their alumni interviews with the class. Class discussion is strongly encouraged.

METEO 897: Special Topics

1-9 Credits

Formal courses given on a topical or special interest subject which may be offered infrequently.

Microbiology - MD (MICRO)

MICRO 550: Current Topics in Virology

1 Credits

This course will investigate current topics related to the field of virology. This may include investigations into host-virus relationships, viruses as agents causing human disease, co-evolution of viruses and their hosts, and antivirals and vaccines. The course will be based on primary literature and will involve an analysis and critique of recent advances and technologies.

MICRO 551: Medical Microbiology

3 Credits

Principles of medical microbiology: host-parasite relationships; structure and function of viruses, bacteria, and fungi as agents causing human disease.

Prerequisite: MICRO550**MICRO 560: Concepts in Immunology**

2 Credits

Concepts in Immunology is designed to instruct students in immunological topics that are typically not covered in depth in lower-level classes in microbiology and/or immunology. These topics usually represent emerging areas in immunology and the specific interests of the teaching faculty and students registered for the course. This course is team-taught and is offered primarily to graduate students. Most students enrolled in this course are either graduate students in the Virology and Immunology Option (VIRIM) of the Biomedical Sciences (BMS) Program or students in other options of the BMS Program but who are conducting thesis research in laboratories of faculty who are in the Department of Microbiology and Immunology. One major objective of this course is to reinforce the students' knowledge in the fundamentals of immunology and to provide a substantially deeper base of knowledge in selected fundamental areas. Another major objective is to broaden the students' scope of immunological concepts through the teaching of interdisciplinary topics in immunology. In the past, such topics have included neuroimmunology, immunological aspects of aging, immunology of atherosclerosis, regulation of the maternal immune response during pregnancy, and pathogenesis of rheumatoid arthritis. Achieving these objectives is accomplished through a combination of didactic lectures and readings/discussion of both primary and review literature. This course is typically offered in the Spring semester of each year and class enrollment usually ranges between three and six students.

MICRO 572: Literature Reports

1 Credits/Maximum of 99

Weekly analysis of current literature in microbiology.

MICRO 581: Immunology A: Basic Concepts in Innate and Adaptive Immunity

1 Credits

Discuss innate immune mechanisms and the basic concepts and molecular/cellular components of adaptive immune system. MICRO 581 Immunology A: Basic Concepts in Innate and Adaptive Immunity (1) This course will cover basic concepts, molecular/cellular components, and recognition mechanisms of innate immune system. It will also include an introduction of the molecular/cellular components of the adaptive immune system. Lectures are based on research literature, although an Immunology textbook will be recommended to the students.

MICRO 582: Immunology B: Adaptive Immunity

1 Credits

Discuss adaptive immune mechanisms. MICRO 582 Immunology B: Adaptive Immunity (1) This course focuses on the mechanisms in the development, activation, and effector functions of the adaptive immune system. It covers the development and activation of lymphocytes, humoral and cellular immunity, cytokines, as well as immunological techniques.

Prerequisite: MICRO581

MICRO 583: Viral Vectors

1 Credits

Use and design of viral vectors in research and use in gene therapy; exploration of viral vector strengths and limitations. MICRO 583 Viral Vectors (1) This course is designed to provide the student with the "big picture" regarding the properties, design, and use of viral vectors within the research laboratory. A basic understanding on the construction of viral vectors, the various methods used for transfection, choice of promoters, as well as considerations regarding Kozak's rules, distance requirements between the 5'-end and the ATG, internal initiation sites, splicing signals, nuclear export signals, polyadenylation etc. In addition, emphasis will also be placed on the future role viral vectors will play in gene therapy and vaccination. One of the strengths of this course is that it will address a subject in translational medicine that is rapidly evolving and the students will be exposed to the dynamic aspects regarding the development of viral vectors for their eventual use in treatment of disease.

Prerequisite: BMS 501 , BMS 502 , BMS 503

MICRO 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

MICRO 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

MICRO 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

MICRO 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

MICRO 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Teaching students laboratory techniques and tests that are used to identify microorganisms and to aid in the diagnosis of disease.

Microbiome Sciences (MBIOM)

MBIOM 550: Current Issues in Microbiome Sciences

1 Credits/Maximum of 8

This course will take a seminar approach to provide a broad survey of current questions being asked involving the microbiome in various systems. Students will complete the course with an improved understanding of current microbiome research goals and techniques. Each week we will focus on a different topic from a diverse pool of areas, presented by established researchers as well as early-

career investigators. In addition to sharing scientific results and accomplishments, this course also offers a community-building experience for students with microbiome interests from diverse departments.

Mineral Processing (MNPR)

MNPR 505: Particle Separation

3 Credits

This course will provide the students with the fundamentals and state-of-the-art techniques in particle separations and their applications in recovery of minerals and elements from primary and secondary sources. The topics covered in this course include: Data Evaluation and Mass Balancing, Gravity Concentration, Froth Flotation, Advanced Dry Separations, Advanced Dewatering Techniques, Classifications, Magnetics, Clarification, Processing of Primary Mineral Resources, and Recycling.

RECOMMENDED PREPARATIONS: Students should be familiar with the fundamentals of mineral process engineering and the content of MNPR 413, or equivalent.

MNPR 507: Hydrometallurgical Processing

3 Credits

Fundamental physico-chemical factors underlying the aqueous extraction and recovery of metals and nonmetals from ores, minerals, and scrap metal. MN PR 507 (MATSE 560) Hydrometallurgical Processing (3) This 3-credit course is concerned with the fundamental physico-chemical processes associated with the processing, utilization, and recycling of materials in aqueous systems. The topics covered cut across a wide range of practical applications. The course is therefore suitable for a broad spectrum of scientists and engineers concerned with processes and processing in aqueous systems, e.g., in materials science and engineering, mineral processing, geoscience, soil science, environmental engineering, chemistry, chemical engineering, petroleum and natural gas engineering, mining engineering, nuclear engineering, and electronic and electrical engineering. A required term paper provides a formal mechanism for ensuring that students have the opportunity to apply ideas discussed in the course to their specific areas of interest.

Prerequisite: MATSE426

Cross-listed with: MATSE 560

MNPR 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

MNPR 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

MNPR 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

Mining (MNG)

MNG 512: Valuation of Mineral Properties and Mining Projects

3 Credits

This course will prepare the students with tools to evaluate mineral resources and mining projects from industrial perspectives. Students are expected to possess basic understanding of geostatistics, economic and accounting principles, and the mining industry in general. This course will provide additional insight in geostatistical methods and the economic and financial decision-making process. Case studies will examine recent major global exploration undertakings to reinforce key concepts.

RECOMMENDED PREPARATIONS: Students are expected to possess basic understanding of geostatistics, economic and accounting principles, and the mining industry in general, as covered in MNG 412, EME 460, or equivalent.

MNG 541: Surface Mine Equipment Selection Analysis

3 Credits

Design analysis and selection criteria for principal surface mine equipment, their interaction in operation, and auxiliary equipment requirements.

Prerequisite: C E 360 , MNG 441

MNG 554: Rock Mechanics Design

3 Credits

Engineering design process; design of mines, tunnels, slopes, and underground chambers; guided design concept; creativity and innovation; group design project.

Prerequisite: MNG 543

MNG 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

MNG 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

MNG 597A: ****SPECIAL TOPICS****

6.00 Credits

MNG 598: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

MNG 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

MNG 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

Molecular, Cellular, and Integrative Biosciences (MCIBS)

MCIBS 503: Critical Elements of Genetics and Molecular and Cellular Biology

4 Credits

Foundational topics and critical analysis in evolution, genetics, molecular and cellular biology and cell differentiation. BIOL (/BMMB/MCIBS/ VB SC) 503 Critical Elements of Genetics and Molecular and Cellular Biology (4) Central elements in genetics, genomics and molecular and cell biology will be covered. The course will focus on foundational principles and concepts that will allow students to understand the behavior of proteins and organelles within cells, and to appreciate how intracellular events influence interactions of cells with one another in multicellular systems and during development. Another major focus will be genome architecture, both in the context of evolution and gene expression. Students will also learn how genetic approaches can be used to understand cell and molecular biology, and will develop critical thinking skills through the analysis of the primary scientific literature. The course will include lecture and discussion sessions.

Cross-listed with: BIOL 503, VBSC 503

MCIBS 511: Molecular Immunology

2 Credits

The study of molecular and biochemical events that influence immune responses and define current questions in immunology. BMMB 511 / MCIBS 511 / VBSC 511 Molecular Immunology (2) The goals of the course are to integrate the current questions of immunology with other disciplines, in particular cell biology and biochemistry, and to provide training in critical thinking and evaluation of data and experiments. The course will be approximately 2/3 lecture by the instructor and 1/3 student presentations of papers related to the material. In addition, written critical reviews of recently published papers and a short research proposal will be assigned. By focusing on the mechanisms involved in immunity and disease, this course complements several existing courses on immunology, virology, and biochemistry. The prerequisites of MICRB 410 and BMB 400 assure that the students enrolling in the course have a general understanding of immunology and biochemistry. This course is projected as an elective for the Molecular Medicine and Immunobiology focus areas in the MCIBS graduate program and for the Pathobiology and BMMB graduate programs. The course will be offered in the fall semester with an enrollment limit of 20 students

Prerequisite: B M B400 , MICRB410

Cross-listed with: BMMB 511, VBSC 511

MCIBS 530: Regulation of gene expression by xenobiotics

3 Credits

The course examines mechanisms by which foreign chemicals alter gene expression and techniques used to analyze these effects. MCIBS (VB SC) 530 Regulation of Gene Expression By Xenobiotics (3) The goals of the present course are to enhance the students' ability to read, design, implement and discuss studies focusing on how chemicals regulate gene expression. Through the use of current research articles, the students will understand the principles of experimental design. They will learn critical reading skills as well as enhance their own research and problem solving abilities. In addition, an emphasis will be placed on presentation clarity and ability to defend scientific inquiry from peers. Thus students will develop critical communication skills. Each student will give several presentations during the semester (depending on the number of students enrolled), each based on a current journal article. All students are expected to read the article and participate in in-class discussions. This course requires a good understanding of biochemistry and molecular biology.

Cross-Listed

MCIBS 535: Oncology: Bench to Bedside

3 Credits

This course is required for graduate students in the MCIBS program who are in the Cancer Biology Emphasis Area. It is designed to give students who are studying cancer at a molecular, reductive level experience with the clinical aspects of the disease. The course will be held at Mt. Nittany Medical Center once a week for 3 hrs, in both patient-oriented, hands-on and didactic settings to understand how cancer is diagnosed, imaged, and treated, how patient care and side effects of therapy are managed, and the importance of clinical trials in developing new treatments for cancer. For each subject area students will spend 2 hours engaged in a clinical experience related to cancer under the supervision of course directors or additional clinicians at Mt. Nittany, followed by a 1 hour lecture/didactic session on a related topic. In addition to broad learning objectives, this course will make students aware of critical issues in cancer biology and treatment that may serve as a springboard for future research.

Prerequisite: MCIBS 503, MCIBS 590, BIOL 416; VBSC 534

Cross-listed with: VBSC 535

MCIBS 551: Genomics

3 Credits

This course will deal with the structure and function of genomes including the use of some current web-based tools and resources for studies and research in genomics. The overall objective is to learn current information about the structure and function of genomes, to develop facility in the many web-based tools and resources for further studies and research in genomics, and to appreciate the power and limitations of current resources and knowledge.

Cross-listed with: BGEN 551, BMBB 551

MCIBS 554: Foundations in Data Driven Life Sciences

3 Credits

Expanded overview of current developments and technique in computational biology and genomics. BMBB (MCIBS) 554 Foundations

in Data Driven Life Sciences (3) The successful progression of data-driven biomedical research is obscured by a wide-range of logistical problems related to data handling and processing, a widespread disconnect between developers and consumers of biomedical analysis software, and lack of accessible, well-developed curricula and active learning opportunities necessary for the development of key data analysis skills in the next generation of researchers and clinicians. This course aims a filling these gaps. Topics include fundamental concepts that underpin analysis of sequence data, design of complex experiments, research transparency and reproducibility, as well as result disseminations practices relevant to presentations and publications.

Cross-listed with: BMBB 554, IBIOS 554

MCIBS 555: Statistical Analysis of Genomics Data

3 Credits

Statistical Analysis of High Throughput Biology Experiments.

Cross-listed with: BIOL 555, STAT 555

MCIBS 571: Current Issues in Biotechnology

2 Credits

Lecture-discussion series by academic and industry experts on the cutting-edge of science, business, intellectual property, legal, social, and ethical issues in biotechnology. The course also requires a group project, involving case studies or market research on various areas of biotechnology. MCIBS 571 Current Issues in Biotechnology (2) Lecture-discussion series by academic and industry experts on the cutting-edge of science, business, intellectual property, legal, social, and ethical issues in biotechnology. The course also requires a group project, involving case studies or market research on various areas of biotechnology.

MCIBS 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

MCIBS 591: Ethics, Rigor, Reproducibility and Conduct of Research in the Life Sciences

2 Credits

An examination of ethics, scientific rigor, data reproducibility, and scientific transparency in the conduct of research in life sciences

MCIBS 592: Current Research Seminar

2 Credits

This course uses a weekly biological seminar as a springboard for discussion of a research topic of high current interest.

MCIBS 593: Molecular Biology Laboratory

3 Credits

An intensive laboratory course on the principles and techniques of nucleic acid purification, analysis by restriction enzymes, gel electrophoresis, nucleic acid labeling and hybridization, cloning, sequencing, PCR amplification, and analysis of cloned heterologous gene expression by western blotting. MCIBS 593 Molecular Biology

Laboratory (3) An intensive laboratory course on the principles and techniques of nucleic acid purification, analysis by restriction enzymes, gel electrophoresis, nucleic acid labeling and hybridization, cloning, sequencing, PCR amplification, and analysis of cloned heterologous gene expression by western blotting.

MCIBS 594: Research Topics

1-15 Credits/Maximum of 15

Supervised student activities on research projects identified on an individual or small-group basis.

MCIBS 595: Internship

1-18 Credits/Maximum of 18

Supervised off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

MCIBS 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

MCIBS 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

MCIBS 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

MCIBS 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

MCIBS 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Supervised experience in teaching and orientation to other selected aspects of the profession at The Pennsylvania State University.

MCIBS 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

MCIBS 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

Music (MUSIC)

MUSIC 500: Introduction to Music Reference and Research Materials

2 Credits

A study of musicological reference and research materials in English and western European languages, with exercises in their use.

MUSIC 505: symphonic Wind Ensemble

1 Credits/Maximum of 4

Rehearsal and performance of wind repertoire and concert band literature.

Prerequisite: admission by audition

MUSIC 507: Philharmonic Orchestra

1 Credits/Maximum of 4

Orchestra rehearsal and performance.

Prerequisite: admission by audition

MUSIC 508: Chamber Orchestra

1 Credits/Maximum of 4

Chamber orchestra rehearsal and performance.

Prerequisite: admission by audition

MUSIC 519: Graduate Seminar in Intermediate Piano Pedagogy

2 Credits

Graduate seminar in intermediate teaching repertoire and strategies for piano from the Baroque to the 21st century. MUSIC 519 Graduate Seminar in Intermediate Piano Pedagogy (2) This course is intended for pianists in the degrees Master of Music and Doctor of Musical Arts who will have already passed the introductory undergraduate course in Intermediate Piano Pedagogy, MUSIC 424, or the current Graduate Seminar in Piano Pedagogy, MUSIC 589 (which will continue to be offered; it is required for piano pedagogy major students in the Master of Music degree), or an equivalent of one of these courses at another institution. The material will be covered in class discussions, reading and listening assignments, and in-class student presentations. Writing, performing, and speaking will be required. The course is designed to give developing professional pianists and piano teachers greater depth of knowledge of the pedagogical repertoire than is possible either in the introductory course or through their own concurrent teaching experiences. The seminar format encourages group discussion as well as independent work.

Prerequisite: MUSIC424 , MUSIC589

MUSIC 520: Chamber Music for Strings

1 Credits/Maximum of 4

Preparation for performance of (advanced) chamber music literature involving primarily stringed instruments—quartets and quintets.

Prerequisite: admission by audition

MUSIC 521: Chamber Music for Woodwinds

1 Credits/Maximum of 4

Preparation for performance of (advanced) chamber music literature involving primarily woodwind instruments--quartets and quintets.

Prerequisite: admission by audition

MUSIC 522: Chamber Music for Brass

1 Credits/Maximum of 4

Preparation for performance of (advanced) chamber music literature involving primarily brass instruments--quartets and quintets.

Prerequisite: admission by audition

MUSIC 523: Sonata Duos

1 Credits/Maximum of 4

Preparation for performance of (advanced) sonata literature for various individual instruments with keyboard.

Prerequisite: admission by audition

MUSIC 524: Graduate Seminar in Advanced Piano Pedagogy

2 Credits

Graduate seminar in advanced repertoire, history of piano pedagogy, and strategies for piano from the Baroque to the 21st century. MUSIC 524 Graduate Seminar in Advanced Piano Pedagogy (2) MUSIC 524 is intended for pianists in the degrees Master of Music and Doctor of Musical Arts who will have already passed the introductory undergraduate course in Intermediate Piano Pedagogy, MUSIC 424, or the current Graduate Seminar in Piano Pedagogy, MUSIC 589 (which will continue to be offered; it is required for piano pedagogy major students in the Master of Music degree), or an equivalent of one of these courses at another institution. The material will be covered in class discussions, reading and listening assignments, and in-class student presentations. Writing, performing, and speaking will be required. The course is designed to give developing professional pianists and piano teachers greater depth of knowledge of the pedagogical repertoire than is possible either in the introductory course or through their own concurrent teaching experiences. The seminar format encourages group discussion as well as independent work.

Prerequisite: MUSIC424 , MUSIC589

MUSIC 531: Analytical Techniques

3 Credits

Twentieth-century theories of tonal music other than Schenker; emphasis on motivic, thematic, metric, and rhythmic analysis.

Prerequisite: MUSIC331

MUSIC 532: Schenkerian Analysis

3 Credits

An intensive introduction to the analytical method developed by the Twentieth-century Austrian theorist and musicologist, Heinrich Schenker.

Prerequisite: satisfactory performance on the graduate theory placement examination

MUSIC 533: The Pedagogy of Undergraduate Theory and History

2 Credits

A study of approaches to the teaching and learning of music theory (written and aural skills) and history.

Prerequisite: MUSIC262 , MUSIC331

MUSIC 535: Composition

1-4 Credits/Maximum of 4

Composition of vocal, instrumental, and electronic media and preparation of compositions for performance.

MUSIC 537: Music Information Retrieval and Computer-Assisted Music

3 Credits

Music Information Retrieval and Computer-Assisted Music have become quite important to electronic musicians recently and will increase in importance over time. The common threads that run through the topics of this course are, first, the mathematics & software that have entered the popular imagination as "big data" & "modeling" and, second, music. An application of these ideas might look like software in which one can search all of Beethoven's works to determine exactly how often he followed a V7 chord with a vi chord; this would be called Music Information Retrieval (MIR). Using a computer to calculate the possible solutions to a species counterpoint exercise might be computer-assisted music theory. The course will have a seminar-like format in which current research is reviewed and students undertake projects in MIR or CAM.

MUSIC 560: Choral Conducting

2 Credits/Maximum of 16

Study of choral conducting techniques, comprehensive score analysis, and supervised rehearsal and performance practicum.

MUSIC 561: Orchestral Conducting

2 Credits/Maximum of 16

Study of orchestral conducting technique, comprehensive score analysis, and supervised rehearsal and performance practicum.

MUSIC 562: Band/Wind Ensemble Conducting

2 Credits/Maximum of 16

Study of band and wind ensemble conducting, comprehensive score analysis, and supervised rehearsal and performance practicum.

MUSIC 565: Studio and Recital Accompaniment

1 Credits/Maximum of 4

Keyboard accompaniment of student soloists in the studio and in public performance, under faculty supervision.

Prerequisite: admission by audition

MUSIC 572: Seminar in Musicology

3 Credits/Maximum of 9

Research in selected areas of music history.

MUSIC 573: Integrative Seminar in Music Theory and History

3 Credits

Special topics (composer, style, genre) taught from both theoretical and historical perspectives.

Prerequisite: MUSIC262 , MUSIC331**MUSIC 574: Seminar in Music Theory**

3 Credits

Study of analytical techniques, aesthetics, writings, in music theory, music cognition, musical sketches, and mathematical models taught from a theory perspective.

Prerequisite: MUSIC432**MUSIC 575: Integrative Conducting Seminar**

1 Credits/Maximum of 2

A seminar for choral, orchestral, and band/wind ensemble graduate conducting majors, taught by conducting faculty in all three areas.

MUSIC 580: Studies in Orchestral Literature

2 Credits/Maximum of 8

Selected studies in orchestral literature from the seventeenth century to the present.

MUSIC 582: Studies in Band/Wind Ensemble Literature

2 Credits/Maximum of 8

Selected studies in band and wind ensemble literature from the Renaissance to the present.

MUSIC 583: Studies in Choral Literature

2 Credits/Maximum of 8

Selected studies in choral literature of all types from the Renaissance to the present.

MUSIC 585: Graduate Seminar in Keyboard Music 1710 to 1820

2 Credits

Seminar in music for keyboards (organ, harpsichord, pianoforte) from the early works of J.S. Bach (c. 1710) to late Beethoven. MUSIC 585 Graduate Seminar in Keyboard Music 1710 to 1820 (2) This first of three seminar courses is intended for pianists in the degrees Master of Music and Doctor of Musical Arts who will have already passed the introductory survey in Keyboard Literature, MUSIC 481 or its equivalent at other institutions. The material, dealing with the periods beginning with late Baroque (J.S. Bach, Handel, Domenico Scarlatti) and ending with Beethoven, will be covered in class discussions, listening assignments, and student presentations in class. Both writing and speaking will be required. The course is designed to give developing professional pianists greater depth and breadth of knowledge of their repertoire than

is possible either in the introductory survey or in their own practice. The seminar format encourages group discussion as well as independent work.

Prerequisite: MUSIC481**MUSIC 586: Graduate Seminar in Piano Music 1820-1920**

2 Credits

Seminar in music for pianoforte from the early works of Schubert, circa 1820, to Rachmaninoff (Romantic and post-Romantic). MUSIC 586 Graduate Seminar in Piano Music 1820-1920 (2) This course is intended for pianists in the degrees Master of Music and Doctor of Musical Arts who will already have passed the introductory survey in Keyboard Literature, MUSIC 481, or its equivalent at other institutions. The material, in this case the Romantic music that is the core of pianists' repertoire, will be covered in class discussions, listening assignments, and student presentations in class. Both writing and speaking will be required. The course is designed to give developing professional pianists greater depth and breadth of knowledge of their repertoire than is possible either in the introductory survey or in their own practice. The seminar format encourages group discussion as well as independent work.

Prerequisite: MUSIC481**MUSIC 587: Graduate Seminar in Piano Music 1890-Present**

2 Credits

Seminar in modern music for pianoforte from the early works of Debussy (circa 1890) to the present day. MUSIC 587 Graduate Seminar in Piano Music 1890-Present (2) This course is intended for pianists in the degrees Master of Music and Doctor of Musical Arts who have already passed the introductory survey in Keyboard Literature, MUSIC 481, or its equivalent at other institutions. The most extensive treatment will be given to Debussy and Ravel in the first weeks, and later to Schonberg and his followers, as well as Bartok, Stravinsky, Hindemith, Ives, Messiaen and other outstanding figures. Less-well known composers of superior accomplishment will also be addressed. The material will be covered in class discussions, listening assignments, and student presentations in class. Both writing and speaking will be required. The course is designed to give developing professional pianists greater depth and breadth of knowledge of their repertoire than is possible either in the introductory survey or in their own practice. The seminar format encourages group discussion as well as independent work.

Prerequisite: MUSIC481**MUSIC 588: Seminar in Music Literature of the Major Performance Area**

1-3 Credits/Maximum of 3

Selected studies in music literature specific to the student's major performance area. Will include research, analysis, and performance.

MUSIC 589: Seminar in Piano Pedagogy

2 Credits

Selected variable topics in piano pedagogy; includes research, performance and discussion of appropriate literature, and class participation.

Prerequisite: MUSIC419 , MUSIC424

MUSIC 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

MUSIC 594: Master's Paper Research

1-6 Credits/Maximum of 6

Investigation of a specific problem in music or music education.

MUSIC 595: Internship

1-18 Credits/Maximum of 18

Supervised off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

Prerequisite: MUSIC419 , MUSIC424 , MUSIC589

MUSIC 595A: **SPECIAL TOPICS**

1 Credits

MUSIC 595B: **SPECIAL TOPICS**

1-2 Credits

MUSIC 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

MUSIC 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

MUSIC 597B: **SPECIAL TOPICS**

1-4 Credits

MUSIC 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

MUSIC 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

MUSIC 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Supervised experience for teaching assistants in music.

MUSIC 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

MUSIC 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

MUSIC 801: Doctoral Solo Recital (DMA)

2-4 Credits/Maximum of 4

Culminating solo recital(s) of artist-level repertoire; may be repeated with different repertoire.

MUSIC 802: DMA Lecture-Recital Monograph

1 Credits

Preparation of a monograph to be text of the DMA lecture-recital; must be approved prior to performance.

MUSIC 803: Performance of the DMA Lecture-Recital

2 Credits

Performance of the D.M.A. lecture-recital (the lecture monograph to be pre-approved as MUSIC 802).

MUSIC 804: Chamber Music Recital (DMA)

1-2 Credits/Maximum of 2

Recital devoted to chamber music (including song groups or cycles for voice and piano). May be repeated.

MUSIC 805: DMA Final Recital

3 Credits

Final, culminating solo recital of artist-level repertoire; independently prepared.

MUSIC 810: Choral Ensemble

1 Credits/Maximum of 4

Rehearsal and performance of choral music. MUSIC 810 Choral Ensemble (1 per semester/maxmum of 4) The goals of Music 810 are to develop the vocal performing skills, music reading abilities, and interpretive capabilities of the class members within a variety of choral ensemble types, including mixed-voice choirs of varying sizes, men's and women's choirs, and choral ensembles focusing on specific musical traditions. Repertoire is selected from Western music as well as world music traditions. The course is for students who have established vocal performance skills. An audition is required.

MUSIC 811: Instrumental Ensemble

1 Credits/Maximum of 6

Rehearsal and performance of instrumental music. MUSIC 811 Instrumental Ensemble (1 per semester/maximum of 6) The goals of Music 811 are to develop the instrumental performing skills, music reading abilities, and interpretive capabilities of the class members

within a variety of instrumental ensemble types. Repertoire is selected from Western music as well as world music traditions. The course is for students who have established instrumental performance skills. An audition is required.

MUSIC 891: Graduate Degree Performance

1 Credits

A juried recital performance for students majoring in performance, composition, or conducting.

MUSIC 896: Individual Studies

1-9 Credits/Maximum of 18

Creative projects with a professional orientation, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

Music Education (MUED)

MUED 540: Quantitative Research Design

3 Credits

This course will develop students' reflection in and on teaching through gaining understanding of systematic inquiry and reflection paradigms. PhD students will become critical readers of research including evaluating appropriate research questions, research designs, and methodological choices. Students will learn data collection techniques, including appropriate protocols for research with human subjects. The research report will reflect understanding of basic human development as well as measurement and evaluation of musical behaviors. Students will develop skills in statistical software packages.

MUED 541: Developing Music Curricula

2 Credits

Introduction to the process for developing music curricula for grades K-12 that reflects current theories/research data as well as state/national guidelines.

MUED 545: Musical Behavior: Creativity, Psychology, & Learning

3 Credits

This course is organized into three interconnected sections. In the first section, students will learn about the origins, nature, and possible reasons for human musical behaviors and responses. In the second section, students will study recent research and experience hands-on opportunities regarding the fundamental concepts within music psychology; specifically acoustics, psychoacoustics, perception, cognition, performance/teaching, and personal/social/societal contexts. Third, the origins, nature, and relationships of creativity and generative music-making will be explored in regard to psychology, cognition, and musical performance research.

MUED 546: Assessment of Music Learning

2 Credits

Exploration of the unique processes, techniques, and challenges involved in the assessment of music learning.

MUED 547: Mentoring Novice Teachers

1 Credits/Maximum of 2

Strategies for mentoring novice music teachers in peer teaching experiences and in K-12 school field experiences.

MUED 550: Qualitative Research in Music Education and the Arts

3 Credits

This course is designed to provide a basic overview of qualitative research methods for graduate students in music education or the arts. It is ideal for those who want to understand the purpose, design, and conduct of qualitative research from several traditions of qualitative inquiry including phenomenology, case study, ethnography, historical models, narrative, and grounded theory. With a focus on interviews and observations as key methods in qualitative research, this course will engage in the selection of gathered materials, the methods and practicalities of completing fieldwork, and multiple approaches to qualitative analysis. Students will develop an in-depth understanding of how to choose an appropriate approach given a specific research question and context and how to implement the approach to gather high-quality qualitative data. Students are guided through a mentored experience in which they design, conduct, analyze, and write a small-scale qualitative study.

MUED 555: Doctoral Seminar in Music Education

1-6 Credits/Maximum of 6

Forum for the discussion of problems in theory and design encountered in individual and group research projects.

Prerequisite: admission to doctoral candidacy

MUED 556: Musical Engagement: Social and Cultural Issues in Music Education

3 Credits

This course provides an opportunity to explore social and cultural issues found within the realm of music education. Theory, teaching practice, and everyday interactions will be key aspects of exploring music as an integral aspect of human life and behavior, and, by extension, within music education. Specific topics to be addressed include methods for examining music in social/cultural contexts and specific cases for examination. Issues of social justice, inclusion, identity, and culturally responsive pedagogy will also be addressed.

MUED 557: Readings in the History of American Music Education

2 Credits

Intensive reading course on the history of American music education and the social, theological, and educational influences on the profession.

MUED 558: Philosophical Issues In Music Education

3 Credits

This course explores historical and contemporary philosophical perspectives in music education and its related disciplines. Taking an interdisciplinary approach, students will engage with the work of notable scholars within the field of music education and the philosophical and theoretical positions that inform their perspectives. Through class discussions and assignments, students will examine different modes of

philosophical inquiry and consider their implications for music education scholarship and practice. Students will hone their ability to examine, evaluate, and critique philosophical claims, developing the intellectual tools to engage with philosophical inquiry.

MUED 559: Contemporary Issues in Music Education

1-2 Credits/Maximum of 2

Consideration of the current political and pedagogical issues that influence curriculum development, teaching, and administration of K-12 music programs.

MUED 597: Special Topics

1-3 Credits/Maximum of 9

Formal courses given infrequently to explore, in depth, a comparatively narrow subject which may be topical or of special interest.

MUED 600: Thesis Research

1-15 Credits/Maximum of 999

MUED 601: Ph D Dissertation Full-Time

0 Credits/Maximum of 999

MUED 602: Supervised Experience in College Teaching

1-2 Credits

Teaching of music education laboratory, and recitation classes under senior faculty supervision.

MUED 610: Thes Res Off Cmpus

1-15 Credits/Maximum of 999

MUED 611: Ph D Dissertation Part-Time

0 Credits/Maximum of 999

Research course.

MUED 860: Capstone Project

3 Credits

MUED 860 is a course dedicated to the design, implementation, and completion of a Capstone Project, a culminating experience for the Master of Music Education degree program. With faculty supervision, students in MUED 860 create a Capstone Project that aligns with individual professional goals. Capstone Projects may include but are not limited to: research projects, literature reviews, curricular design projects, practitioner resources, etc.

MUED 895: Practicum in Music Teaching

1 Credits/Maximum of 4

Field experiences in music teaching for graduate students in music education.

Music-Brass (BRASS)

BRASS 500: Trumpet: Secondary

1 Credits/Maximum of 1

Individual instruction in trumpet one-half hour per week.

BRASS 501: French Horn: Secondary

1 Credits/Maximum of 1

Individual instruction in French horn one-half hour per week.

BRASS 502: Trombone: Secondary

1 Credits/Maximum of 1

Individual instruction in trombone one-half hour per week.

BRASS 503: Euphonium: Secondary

1 Credits/Maximum of 1

Individual instruction in euphonium/baritone one-half hour per week.

BRASS 504: Tuba: Secondary

1 Credits/Maximum of 1

Individual instruction in tuba one-half hour per week.

BRASS 510: Trumpet: Secondary

2 Credits/Maximum of 2

Individual instruction in trumpet one hour per week.

BRASS 511: French Horn: Secondary

2 Credits/Maximum of 2

Individual instruction in French horn one hour per week.

BRASS 512: Trombone: Secondary

2 Credits/Maximum of 2

Individual instruction in trombone one hour per week.

BRASS 513: Euphonium: Secondary

2 Credits/Maximum of 2

Individual instruction in euphonium/baritone one hour per week.

BRASS 514: Tuba: Secondary

2 Credits/Maximum of 2

Individual instruction in tuba one hour per week.

BRASS 530: Trumpet: Performance

4 Credits/Maximum of 4

Individual instruction in trumpet one hour per week. For graduate trumpet performance majors.

BRASS 531: French Horn: Performance

4 Credits/Maximum of 4

Individual instruction in French Horn one hour per week. For graduate French horn performance majors.

BRASS 532: Trombone: Performance

4 Credits/Maximum of 4

Individual instruction in trombone one hour per week. For graduate trombone majors.

BRASS 533: Euphonium: Performance

4 Credits/Maximum of 16

Individual instruction in euphonium one hour per week. For graduate euphonium majors.

BRASS 534: Tuba: Performance

4 Credits/Maximum of 4

Individual instruction in tuba two sessions per week. For graduate tuba performance majors.

Music-Keyboard (KEYBD)

KEYBD 500: Piano: Secondary

1 Credits

Individual instruction in piano one-half hour per week. For students who qualify.

KEYBD 501: Organ: Secondary

1 Credits

Individual instruction in pipe organ one-half hour per week. For students who qualify.

KEYBD 510: Piano: Secondary

2 Credits

Individual instruction in piano one hour per week. For students who qualify.

KEYBD 530: Piano: Performance

4 Credits

Individual instruction in piano one hour per week. For graduate piano performance majors.

KEYBD 580: Piano Performance Doctoral/Artist Level

4 Credits/Maximum of 4

One-hour weekly piano lessons with jury examination at end of each semester; repeatable course; four semesters required. KEYBD 580J Piano Performance Doctoral/Artist Level (4)KEYBD 580J consists of one-hour weekly lessons, like other private applied music lessons in the School of Music. The repertoire to be performed and the standards of preparation will be at the highest level, for pianist-students in the degree Doctor of Musical Arts, who will have already completed a Master of Music in

Performance. This standard, which will be enforced via a jury examination at the end of the semester, will require large amounts of independent practice, and therefore will be valued at four credits per semester. Four semesters minimum (16 credits) will be required.

Music-Percussion (PERCN)

PERCN 500: Percussion: Secondary

1 Credits

Individual instruction in percussion one-half hour per week.

PERCN 510: Percussion: Secondary

2 Credits

Individual instruction in percussion one hour per week.

PERCN 530: Percussion: Performance

4 Credits

Individual instruction in percussion one hour per week. For graduate percussion performance majors.

Music-Strings (STRNG)

STRNG 500: Violin: Secondary

1 Credits

Individual instruction in violin one-half hour per week. For students who qualify.

STRNG 501: Viola: Secondary

1 Credits

Individual instruction in viola one-half hour per week. For students who qualify.

STRNG 502: Violoncello: Secondary

1 Credits

Individual instruction in violoncello one-half hour per week. For students who qualify.

STRNG 503: Double Bass: Secondary

1 Credits

Individual instruction in double bass one-half hour per week. For students who qualify.

STRNG 510: Violin: Secondary

2 Credits

Individual instruction in violin one hour per week. For students who qualify.

STRNG 511: Viola: Secondary

2 Credits

Individual instruction in viola one hour per week. For students who qualify.

STRNG 512: Violoncello: Secondary

2 Credits

Individual instruction in violoncello one hour per week. For students who qualify.

STRNG 513: Double Bass: Secondary

2 Credits

Individual instruction in double bass one hour per week. For students who qualify.

STRNG 530: Violin: Performance

4 Credits/Maximum of 4

Individual instruction in violin one hour per week. For graduate violin performance majors.

STRNG 531: Viola: Performance

4 Credits

Individual instruction in viola one hour per week. For graduate viola performance majors.

STRNG 532: Violoncello: Performance

4 Credits

Individual instruction in violoncello one hour per week. For graduate violoncello performance majors.

STRNG 533: Double Bass: Performance

4 Credits

Individual instruction in double bass one hour per week. For graduate double bass performance majors.

Music-Voice (VOICE)

VOICE 500: Voice: Secondary

1 Credits

Individual instruction in voice one-half hour per week.

VOICE 510: Voice: Secondary

2 Credits

Individual instruction in voice one hour per week.

VOICE 530: Voice: Performance

3-4 Credits/Maximum of 16

Individual instruction in voice one and one-half hours per week. For graduate voice performance majors.

Music-Woodwinds (WWNDS)

WWNDS 500: Flute: Secondary

1 Credits

Individual instruction in flute one-half hour per week.

WWNDS 501: Oboe: Secondary

1 Credits

Individual instruction in oboe one-half hour per week.

WWNDS 502: Clarinet: Secondary

1 Credits

Individual instruction in clarinet one-half hour per week.

WWNDS 503: Bassoon: Secondary

1 Credits

Individual instruction in bassoon one-half hour per week.

WWNDS 504: Saxophone: Secondary

1 Credits

Individual instruction in saxophone one-half hour per week.

WWNDS 510: Flute: Secondary

2 Credits

Individual instruction in flute one hour per week.

WWNDS 511: Oboe: Secondary

2 Credits

Individual instruction in oboe one hour per week.

WWNDS 512: Clarinet: Secondary

2 Credits

Individual instruction in clarinet one hour per week.

WWNDS 513: Bassoon: Secondary

2 Credits

Individual instruction in bassoon one hour per week.

WWNDS 514: Saxophone: Secondary

2 Credits

Individual instruction in saxophone one hour per week.

WWNDS 530: Flute: Performance

4 Credits

Individual instruction in flute one and one-half hour per week. For graduate flute performance majors.

WWNDS 531: Oboe: Performance

4 Credits

Individual instruction in oboe one hour per week. For graduate oboe performance majors.

WWNDS 532: Clarinet: Performance

4 Credits

Individual instruction in clarinet one hour per week. For graduate clarinet performance majors.

WWNDS 533: Bassoon: Performance

4 Credits

Individual instruction in bassoon one hour per week. For graduate bassoon performance majors.

WWNDS 534: Saxophone: Performance

4 Credits

Individual instruction in saxophone one hour per week. For graduate saxophone performance majors.

Nanotechnology (NANO)

NANO 521: Pattern Transfer at the Nano-scale

3 Credits

Engineering at the nano-scale often requires creating and then transferring a pattern when fabricating a desired nano-scale structure. This course explores the basic processes of pattern design and then addresses the techniques used to transfer a nano-scale pattern to a surface or structure. The course looks into pattern transfer techniques that employ particles, photons, and additional chemical and physical means as the transfer mechanisms. Included in the photon approaches are studies of deep UV and X-ray pattern transfer. Particle transfer mechanisms discussed include ion and neutral particle approaches. Physical-contact pattern transfer is also explored including discussions of nano-imprinting lithography, nano-molding lithography, and scanning probe lithography. Chemical pattern transfer is another approach to pattern transfer and one that uniquely uses chemical processes to create patterns. Examples to be discussed in this course include molecular self-assembly lithography and block co-polymer lithography. Emerging pattern transfer techniques, such as magneto-lithography, will be included in E SC 521 for completeness. In many of these pattern transfer methodologies, a "writing" of the transferring pattern into some intermediary medium termed a resist is required. In pattern technologies requiring resists, the resist materials and their positioning as well as required physical and chemical properties will be discussed.

Prerequisite: ESC 520

Cross-listed with: ESC 521

NANO 523: Fabrication and Characterization for Bottom-up Nano-manufacturing

3 Credits

There are two broad approaches to fabrication and manufacturing at the nano-scale: bottom-up and top-down nanofabrication. These are

complementary with the former having strong ties to biology and the latter having strong ties to traditional semiconductor processing. E SC 523 focuses on the bottom-up approaches, which provide an increasingly important alternative to top-down techniques. Bottom-up approaches to nano-scale fabrication mimic nature in harnessing fundamental chemical or physical forces operating at the nano-scale to assemble basic units into larger structures. The bottom-up, or self-assembly, techniques explored in this course cover material synthesis, structure fabrication, and material and structure characterization. The production of 0-D, 1-D, 2-D, and 3-D materials will be discussed and then the assembly of these materials into structures will be explored. Fabrication topics to be covered will include block co-polymer manipulation, vapor-liquid-solid growth, the Langmuir-Blodgett technique, surface functionalization, molecular self-assembly, DNA Origami, and bacterial and viral assembly. The characterization techniques to be covered will include those emerging tools capable of ultra-precise resolution such as tip-enhanced Raman scanning microscopy, scanning helium ion microscopy, and magnetic resonance sub-nanometer imaging.

Prerequisite: E SC 412, E SC 520, E SC 521

Cross-listed with: ESC 523

Neuroscience - MD (NEURO)

NEURO 501: Neuroscience Seminar

2 Credits/Maximum of 8

This is a weekly seminar involving discussion of research approaches and methodologies used by guest speakers for the neuroscience seminar series. NEURO 501 Neuroscience Seminar (2 per semester/ maximum of 8) This course examines issues related to the research presented by invited speakers in the Neuroscience Seminar series. This is a required course for first and second-year graduate students in the Neuroscience program. The intent is to generate discussion that aids in the understanding of the general research questions, techniques and conclusions reflected in the work of the various speakers. Speakers will address topics ranging from the molecular to human behavior. The Neuroscience Seminar course has two components: (1) the students present on the background research (approaches, methods, and concepts) related to the invited speaker's work. The students will read 2-3 papers from a list of the speaker's publications prior to the seminar. The host of the invited speaker (and sometimes the speaker himself or herself, depending on availability) will join the students in the discussion. Each time there will be one student who leads the discussion. Students will participate in discussions with the invited speaker, the instructor, and with other students who may have different research experiences and backgrounds. (2) the students will attend the seminar delivered by the invited speaker and participate in the discussion and question and answer periods.

NEURO 511: Neurobiology II

3 Credits

Structure and physiology of central and peripheral nervous system, including specific sense organs.

Prerequisite: graduate student status

NEURO 512: Comparative Neuroanatomy

4 Credits

This course elucidates the structural organization of the nervous system and describes the evolutionary principles that guide brain development. NEURO 512 Comparative Neuroanatomy (4) This course provides instruction on the functional and structural organization of the vertebrate central nervous system. In addition to lectures, students attend laboratory sessions devoted to human brain dissections, histologic sections of various vertebrate brains, and non-invasive magnetic resonance images. Following instruction on the structural and physiological properties of neurons, students learn how structural and neurochemical variations endow neurons with specific computational properties so that connections between different neuronal subtypes enable local circuits to extract information and create specific input-output transformations that define the functional character of each neural system. The structural organization of the brain is then described both grossly and at the level of functional circuits. Material at the gross level describes the 3-D spatial relationships among the nuclei and fiber tracts within each subdivision of the central nervous system so that students can describe the internal organization of the forebrain, midbrain, hindbrain, and spinal cord. As part of this, students learn to recognize specific structures in different planes of sections along the major axes of the brain. Material at the functional level describes the sensory, motor, and limbic systems according to their circuit connections. Emphasis is placed on the specific connections that enable circuits to transform specific types of information. Students are expected to describe the successive series of nuclei and interconnected pathways that comprise each major neural system. Students are also taught to view neuroanatomy as a scientific field of inquiry. Landmark discoveries and the methods by which prominent neuroanatomists made those discoveries provide a context for describing brain organization. Breakthrough scientific experiments are discussed to illustrate how the structural-functional relationships of the brain have been elucidated. Attention is also devoted to instructing students in modern experimental methods that are used to determine how brain circuits are altered by experimental manipulations. While the course emphasizes the mammalian nervous system, many aspects of brain organization in non-mammalian vertebrates are presented. In the last third of the course, students read a monograph focused on the principles that guided vertebrate brain evolution across different phylogenetic lineages. A series of lectures are devoted to neurocladistics and the evidence that has prompted competing theories of brain evolution so that students can critically evaluate differences in brain organization across different groups of vertebrates.

NEURO 515: Developmental Neurobiology

2 Credits

Development of the nervous system in all its aspects.

Cross-listed with: ANAT 515

NEURO 520: Cellular and Molecular Neuroscience

3 Credits

This course covers the biology and function of neurons at the cellular level. It provides a broad exploration of how neurons communicate with each other chemically and electrically. In particular, it investigates how the electrical properties of cells and their ion channels are used to generate action potentials and electrical signals, how neurons communicate with each other chemically, and how these chemical

signals are transduced. Students will gain awareness of modern methods to visualize, identify, record from, and manipulate the activity of neurons. Building on these insights, students will use this knowledge to analyze and critique the current neuroscience literature and apply this knowledge to the design of experiments in the context of neuroscience research.

Cross-listed with: ESC 526

NEURO 521: Systems Neuroscience

3 Credits

An introduction to the major neural systems and their integrative functions.

NEURO 522: Seminars in Neuroscience I

2 Credits

Study at the cellular, molecular, and metabolic level of selected subjects in neuroscience.

NEURO 523: Seminars in Neuroscience II

2 Credits

Study at the cellular, molecular, and metabolic level of selected subjects in neuroscience.

NEURO 524: Neuroscience Bootcamp

2 Credits

This is a laboratory course that meets twice weekly. The goal of this course is to engage incoming graduate students in the Neuroscience Program to a didactic/hands-on methods-based primer and overview of modern neuroscience laboratory methodology. After successful completion of this course, students will be able to: - Demonstrate an understanding of basic laboratory safety and standard laboratory practices. - Demonstrate an understanding of how to keep data and records in a proper laboratory notebook. - Demonstrate an understanding of basic laboratory approaches used in a modern neuroscience research lab to address questions in neuroscience. - Demonstrate an understanding of how to perform and interpret laboratory experiments and analyze data acquired from those experiments.

NEURO 530: Professional Development and Responsible Conduct in Science

1 Credits

An introduction to the professional skills necessary for careers in biomedical sciences.

NEURO 531: Neuroethics: Science, Technology, and Society

3 Credits

This course provides a close examination into the field of neuroethics and the responsible application of advances in neuroscience research and neuroengineering. Neuroethics is a relatively young and interdisciplinary field of inquiry that aims to be a platform for different stakeholders, including neuroscientists, clinicians, lawyers, engineers, policy makers and the general public to discuss the future of neuroscience and the different applications of neurotechnologies. Neuroethics is a field that brings normative, descriptive, theoretical and practical considerations at the table. This course will cover topics such as different perspectives

on neuroethics, its scope and role in recent brain initiatives, ethical and societal implications of brain imaging for medical and non-medical purposes, ethical and societal implications of the use of pharmacological and neuromodulation interventions on the brain, uses of neuromodifiers for enhancement purposes, issues around personhood and other emerging topics relevant to neuroethics. Among the ethical issues examined in the course are issues related to mental privacy, safety considerations, responsibility, agency, and social justice.

Recommended Preparation: An understanding of ethics, societal implications of technology, and neuroscience or neurotechnology background. Courses in functional and integrative neuroscience, as well as courses that provide a grounding in bioethics
Cross-listed with: BIOET 531, ESC 531

NEURO 580: Translational Medicine in Substance Use Disorder

3 Credits

This course provides students with insight into the dynamic and ongoing relationship between laboratory research and clinical practice as it relates to substance use disorder. Students will shadow a clinician in order to observe the current clinical treatment strategies for substance use disorder as well as learn about how this chronic disease affects the afflicted patients. In parallel, weekly lectures and classroom discussions will provide students with the most up-to-date understanding of the physiological mechanisms mediating substance use disorder based on preclinical and clinical data. To provide students with a government and health insurance perspective on substance use disorder, this course will discuss policies put in place to control illicit drug use as well as discuss the approach insurance companies take when covering patients getting treatment. The goal of this course is to provide students with a comprehensive understanding of drug addiction at the clinical, preclinical, and government levels with the purpose of training students to observe clinical needs and address them through experimental design.

COREQUISITES: BMS 571 RECOMMENDED PREPERATION: The student must: (a) be at least a 2nd year graduate student (b) select a thesis relevant clinical rotation and (c) have been approved by the course director

NEURO 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students or outside speakers.

NEURO 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

NEURO 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

NEURO 600: Thesis Research

1-15 Credits/Maximum of 999

Thesis Research

NEURO 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

NEURO 602: Supervised Experience in College Teaching

1 Credits/Maximum of 2

Supervised experience in teaching and orientation to other selected aspects of the profession at The Pennsylvania State University

Prerequisite: NEURO 511, NEURO 520, NEURO 521

NEURO 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No Description.

Nuclear Engineering (NUCE)

NUCE 501: Reactor Engineering

3 Credits

Thermal hydraulic fundamentals applied to power reactors, thermal analysis of fuel elements and two-phase heat transfer in heated channels.

Prerequisite: NUC E430

NUCE 502: Reactor Core Thermal-Hydraulics

3 Credits

In-depth analysis of the reactor core thermal hydraulics; computational methods and practical applications. NUC E 502 Reactors Core Thermal-Hydraulics (3) This course provides students with a background in reactor core thermal hydraulics and enhances their understanding of the important phenomena in a nuclear reactor core, which can determine reactor safety performance. Students will obtain an overall view of reactor safety from the reactor thermal hydraulics perspective. This course examines the outcomes of research projects and international scientific activities in this area. Objectives are met by introducing course modules that utilize state-of-the-art computer codes to solve well established international thermal-hydraulics benchmark problems to demonstrate reactor performance during operational transients. One of the principal goals of the course is to provide students with a computationally intensive curriculum that is consistent with their capabilities and their expectations for a modern reactor thermal hydraulics course. This course discusses detailed thermal-hydraulic analysis of reactor systems with an emphasis on the application of conservation equations for single- and two-phase flow in detailed modeling of reactor cores using three-dimensional subchannel analysis methods and examines the reactor's core thermal-hydraulic design for core limit analysis. The governing sets of equations that form the basis for the three-dimensional thermal-hydraulic methods commonly used in the nuclear industry will be derived and discussed in addition to specific models that are used for closure. Hot assembly analysis will be

performed, as well as core wide analysis, to determine the hot assembly and resulting hot subchannels in the core. Students will use state-of-the-art three-dimensional computer codes to model fuel assemblies and the reactor core to determine the most limiting fuel pin and hottest subchannel. Background on heat and mass transfer and fluid dynamics is the prerequisite to this course, which provides a basis for understanding reactor core thermal-hydraulic analysis.

Prerequisite: NUC E430

NUCE 505: Reactor Instrumentation and Control

3 Credits

Reactor control principles; classical control methods; operational control problems; control simulation using modern mainframe and microcomputer software packages; reactor instrumentation.

Prerequisite: NUC E302 or NUC E401

NUCE 506: Nuclear Chemistry

3 Credits

Energetics, kinematics, and models of nuclear reactions; nuclear processes as chemical probes, mossbauer effect and perturbed angular correlation spectroscopy.

NUCE 509: Physics of Radiation Damage

3 Credits

Radiation damage plays a pivotal role in materials design for radiation-intensive applications, such as in fission and fusion nuclear reactors. Atoms in solid materials can be displaced from their lattice sites due to interactions with energetic radiation particles, generating a variety of point defects and defect clusters that can profoundly modify the material properties, such as mechanical strength, dimensional stability, thermal conductivity, as well as electrical and optical properties. This course provides students with the fundamental theories and methodologies essential for the research of materials to be used in radiation-intensive environments. Key topics include: (1) theories for energy deposition from energetic particles into materials, (2) analytical models for atomic displacement and collision cascades, (3) kinetics of point defects and defect clusters, emphasizing rate theory and related models, and (4) defect-property relationship in materials.

NUCE 511: Nuclear Reactor Kinetics and Dynamics

3 Credits

Analytical kinetics and dynamics modeling for reactivity-induced transients; reactor accident kinetics methods for simple and complex geometries; experimental methods. NUC E 511 Nuclear Reactor Kinetics and Dynamics (3) This course provides students with a background in the area of nuclear reactor kinetics and dynamics and enhances their understanding of the important multi-physics phenomena in a reactor, which can determine reactor safety performance. Students will obtain an overall view of nuclear reactor safety from the nuclear reactor dynamics perspective. This course examines the outcomes of research projects and international scientific activities in the area of reactor dynamics. Objectives are met by introducing course modules that utilize state-of-the-art computer codes to solve well established international coupled thermal-hydraulics and neutronics benchmark problems to demonstrate reactor performance during operational transients. The course will be based on modules that demonstrate the Light Water Reactor

(LWR) behavior utilizing state-of-the-art computer codes to solve well established Organization for Economic Cooperation and Development (OECD) coupled code benchmark problems. A supplementary module will also be developed which focuses on the High Temperature Reactor (HTR) in order to demonstrate the dynamic and safety issues unique to an advanced next generation reactor. The course will provide students with a computationally intensive modular curriculum that the instructor can utilize as appropriate to complement the nuclear reactor kinetics and dynamics concepts. This course focuses on nuclear reactor kinetics and dynamics methods and techniques for multi-dimensional safety and transient analysis. It consists of five major topics: review of point nuclear reactor kinetics theory; reactivity feedback and nuclear reactor dynamics; methods for spatial kinetics; coupled and multi-dimensional thermal-hydraulics/neutron kinetics; and, experimental determination of reactor dynamics parameters. A computer project provides students with knowledge about state-of-the-art methods used to model reactor transients for safety evaluations. Background on basic reactor physics and analysis is the prerequisite content to this course, which provides a basis for understanding nuclear reactor kinetics theory and nuclear reactor dynamics phenomena.

Prerequisite: NUC E301 ; NUC E302

NUCE 512: Nuclear Fuel Management

3 Credits

Nuclear fuel inventory determination and economic value through the fuel cycle. Emphasis on calculational techniques in reactor, optimization, and design.

Prerequisite: NUC E302

NUCE 521: Neutron Transport Theory

3 Credits

Derivation of Boltzmann equation for neutron transport; techniques of approximate and exact solution for the monoenergetic and spectrum regenerating cases.

Prerequisite: NUC E403 or PHYS 406

NUCE 523: Environmental Degradation of Materials in Nuclear Power Plants

3 Credits

Degradation of materials performance when exposed to the combination of high temperature, neutron irradiation, and aggressive electrochemistry found in nuclear reactors.

Prerequisite: MATSE409

Cross-listed with: MATSE 523

NUCE 525: Monte Carlo Methods

3 Credits

Fundamentals of the probability theory and statistics, analog and non-analog Monte Carlo methods and their applications, random processes, and numbers.

Prerequisite: MATH 141 , PHYS 237 , STAT 401

NUCE 530: Parallel/Vector Algorithms for Scientific Applications

3 Credits

Development/analysis of parallel/vector algorithms (finite-differencing of PDEs and Monte Carlo methods) for engineering/scientific applications for shared and distributed memory architectures.

Prerequisite: AERSP424 or CMPSC450

NUCE 540: Theory of Plasma Waves

3 Credits

Solutions of the Boltzmann equation; waves in bounded and unbounded plasmas; radiation and scattering from plasmas.

Prerequisite: E E 471

Cross-listed with: AERSP 540

NUCE 542: Source and Detector Technologies for Nuclear Security

3 Credits

Theory and Technology behind detectors, sensors, and source technologies including portal monitors and field deployable detection systems.

Prerequisite: NUC E 450

NUCE 543: Nuclear Security Education Laboratory

3 Credits

Hands-on Experience with the radiation detection systems, sensors, devices, and source technologies for nuclear security applications.

Prerequisite: NUC E 450, NUC E 542

NUCE 544: Global Nuclear Security Policies

3 Credits

This course reviews the historical development and examines the current state of American and international policies and laws related to global nuclear security. U.S. policy has evolved over a period of more than sixty years since the Manhattan Project and has embraced the importance of both safeguards (applicable to weapons states and non-weapons states that commit to peaceful use of nuclear materials) and proliferation prevention (policies intended to deter and detect attempts to illicitly acquire nuclear weapons). Over this time improvements in technology have increased the potential for proliferation but have also increased the ability to detect proliferation. Recently, heightened danger of unauthorized proliferation by states and, more worrisome, transnational non-states, has led to increased emphasis on control and detection. Within this context students in this course will study U.S. national security strategy in the areas of counterterrorism and nonproliferation. We will discuss those policies aimed at enhancing nuclear security and examine the roles of various agencies, including the Department of Homeland Security, the Department of Energy (including the National Nuclear Security Administration), the Nuclear Regulatory Commission, the Department of Defense, and the Environmental Protection Agency. International treaties and conventions on nuclear safeguards, arms control, and terrorism will be covered. Regulations promulgated by the U.S. Nuclear Regulatory Commission and the International Atomic Energy Agency will also be studied. The course will consider how these policies are intended to control the actions of both state and non-state

adversaries and applications to both government and private sector nuclear activities. The role of transnational and domestic groups will be discussed, especially with regard to motivation and potential capabilities.

NUCE 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

NUCE 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

NUCE 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

NUCE 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

NUCE 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

NUCE 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Graduate assistants receive credit for teaching lower level courses while under the direct supervision of a graduate faculty member.

Prerequisite: graduate student standing in nuclear engineering

NUCE 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

NUCE 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

Nursing (NURS)

NURS 501: Issues in Nursing and Health Care

3 Credits

Analysis and evaluation of the health care system with emphasis on health policy and economic issues affecting nursing practice. NURS 501 Issues in Nursing and Health Care (3) This course will focus on the state of the U.S. health care system within global, health policy, and economic

perspectives. The course will cover current and complex issues and trends specific to nursing, and in the broader context of interdisciplinary health care. Master's level nurses will develop beginning mastery over the concepts and principles of health care policy, and the leadership skills necessary to influence policy changes in health care within organizations and on a national, state or local level.

NURS 510: Theoretical and Scientific Foundations of Advanced Nursing Practice

3-6 Credits

Examines the relationship of nursing theories to the development of nursing science, as well as current scientific advances that guide nursing practice and research.

NURS 513: Evidence-Based Practice in Professional Nursing

3 Credits

NURS 513 Evidence-Based Practice in Professional Nursing (3) focuses on the analysis and synthesis of research to develop the project. Students will identify a significant issue or problem that is common in their area of nursing practice. These practice areas may include advanced practice nursing specialties, nursing education, or nursing administration. Students will systematically search, analyze, and synthesize relevant research literature to make recommendations for evidence-based nursing practice, education, or administration.

Prerequisite: NURS 512

NURS 522: Comprehensive Assessment of the Older Adult

3 Credits

In-depth assessment of biological, physical, clinical, functional, cognitive, psychological, and social changes associated with aging. NURS 522 Comprehensive Assessment of the Older Adult (3) This course provides an in-depth interdisciplinary assessment of the biological, physical, clinical, functional, cognitive, psychological, and social changes associated with aging. Students will be provided with foundational information about the process of aging along with a global perspective on aging. The primary focus of the course is an assessment of the unique issues encountered by the older adult. Legal, financial, and other economic concerns will also be explored.

NURS 523: Interventions for Common Health Issues in Older Adults

3 Credits

Discussion of common acute and chronic health issues experienced by older adults and development of evidence-based interventions/personal approaches for management. NURS 523 Interventions for Common Health Issues in Older Adults (3) This course presents both common acute and chronic health issues experienced by older adults. Using a systems approach, interventions will be discussed specifically addressing an aging person. The development of evidence-based interventions/personal approaches for management will be stressed. Other age-specific concerns and issues faced by older adults, such as end-of-life care, and care transition, and finances will be discussed.

NURS 578: Mixed Methods in Health Research

3 Credits

This core PhD nursing research course gives an overview of the design and conduct of mixed methods research, in which both qualitative and quantitative data are collected, analyzed, and integrated within a single study, enabling a multi-faceted understanding of nursing phenomena. This course will review the assumptions and mental models that inform both approaches, and the ways in which qualitative and quantitative questions, methods, analytic approaches, and dissemination can be integrated. This course will highlight the main five designs of mixed methods in the social, behavioral and health sciences: (1) explanatory sequential; (2) exploratory sequential; (3) embedded; (4) convergent parallel; and (5) transformative. Current literature and guidelines from the National Institutes of Health will serve as primary resources. The course will not address advanced statistical analysis methods.

NURS 579: Overview of Nursing Scholarship

1 Credits

In this course, students will develop foundational skills for engaging in nursing, research, and scholarship.

NURS 580: Theoretical and Philosophical Basis of Nursing

3 Credits

This course gives students an overview of the process of intellectual inquiry, exploring the foundations of scholarly disciplines in general and the discipline of nursing in particular. The current state of nursing science, criteria for causation, and argumentation will be explored, with emphasis on historical, philosophical, positivist, gendered, and phenomenological ways of knowing. Structure, components, assumptions, limitations, methodologies, and types of reasoning will be evaluated with regard to the development of nursing knowledge. The intent of this course is to provide students with the opportunity to have a formative background in and analyze selected aspects of knowledge creation, particularly as this knowledge informs their individual research interests.

Prerequisite: NURS 510 or an equivalent nursing theory course; Master's degree in Nursing

NURS 582: Literature Synthesis for Nursing Science

3 Credits

In this course, the scientific basis of nursing will be critically and systematically appraised. Students will focus their inquiry on a self-selected area of research with the goal of developing the foundation of the literature review for their dissertation.

Prerequisite: NURS 580

NURS 583: Advanced Seminar in Nursing Science

1 Credits/Maximum of 3

Interactive seminar for developing a dissertation and discussing dissertation-related issues. Through a seminar format, this course will review the components part of a dissertation through the lens of giving and receiving both peer and faculty feedback.

Prerequisites: NURS 580 or NURS 582 or NURS 585 or NURS 586

NURS 584: Roles and Responsibilities of the Nurse Scientist

3 Credits

This course provides students with an overview of career opportunities and responsibilities related to nursing science. An overview of responsible conduct for research including: conflict of interest, protection of human subjects, authorship, and misconduct. Career cartography will act as a framework for developing a career trajectory, including job placement, funding sources, working within complex team settings. The role of the nurse scientist related to intradisciplinary and interdisciplinary research and mentorship. An overview of a comprehensive plan for dissemination of research findings will be presented.

NURS 585: Qualitative Methods in Health Research

3 Credits

Provides an overview of advanced qualitative research methodologies useful in the conduct of social and behavioral health research.

NURS 586: Quantitative Methods in Health Research

3 Credits

An overview of methodological considerations specific to quantitative health research.

NURS 587: Ethics in Health Research

1 Credits

Provides the theoretical and practical knowledge needed to design and conduct ethically responsible social and behavioral health research.

NURS 588: Healthcare Policy for Nurse and Healthcare Scholars

3 Credits

This course prepares scholars to influence healthcare and related policies. Theories of social justice and other scholarly perspectives are used to explore the interrelationships among health policy and the social, political, and economic determinants of health. Strategies for developing, initiating, analyzing, and evaluating health policies are proposed using students' areas of foci as a basis. The course provides the foundation for leadership in interdisciplinary collaborative endeavors to address health policy at the regional, national, and global levels.

NURS 589: Grant Writing in Health Sciences

3 Credits

This seminar provides a foundation for students to identify appropriate funding mechanisms and prepare research type grant applications for the National Institutes of Health (NIH) as the focal point of submission; however, knowledge and skills gained in this seminar will be relevant to other funding sources and mechanisms. The seminar will provide strategies needed to write competitive grant applications, develop research teams, prepare budgets, and understand the peer review process.

NURS 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

NURS 594: Research Topics

1-18 Credits/Maximum of 18

Supervised student activities on research projects identified on an individual or small-group basis.

NURS 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

NURS 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

NURS 598: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

NURS 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

NURS 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

NURS 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Provides an opportunity for supervised and graded teaching experience in undergraduate nursing courses.

NURS 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

NURS 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

NURS 802: Advanced Health Assessment of Adult Populations

3 Credits

Advanced nursing assessment and diagnosis of physical, psychosocial and developmental health for adults and families across the adult age spectrum.

NURS 802A: Advanced Health Assessment of Pediatric Populations

1 Credits

Advanced nursing assessment and diagnosis of physical, psychosocial and developmental health for individuals and families across the pediatric age spectrum.

NURS 802B: Physical Assessment Through The Lifespan

3 Credits

Nursing assessment and diagnosis of physical, psychosocial, and developmental health across the lifespan. NURS 802 Physical Assessment Through The Lifespan (3) This course focuses on the comprehensive assessment of patients across the lifespan; including newborns, infants, children, pre-adolescents, adolescents, childbearing women, adults, and older adults. Comprehensive assessment includes normal changes and common health problems across the lifespan, and atypical presentations of diseases commonly seen in patient populations. Assessment instruments specific to each population group will be reviewed.

NURS 802M: Psych MHNP Integrative Biopsychosocial Assessment & Differential Diagnosis Across the Lifespan

2 Credits

This is a comprehensive professional practice course in which students learn the Psychiatric Mental Health Nurse Practitioner (PMHNP) role focused on the biopsychosocial assessment integrating aspects of biological, familial, community, and social health. Identification and management of psychiatric diagnoses of diverse populations across the lifespan. The student will integrate newly acquired and previously mastered knowledge while developing differential diagnoses. Content focuses on epidemiological, cultural, ethical, and economic factors related to the psychiatric population in the context of diagnoses, treatment options, and quality improvement processes.

Prerequisite: NURS 802 and NURS 802A and NURS 803 and NURS 804 and NURS 871M

NURS 803: Pathophysiology for the Advanced Practice Nurse

3 Credits

Integration of advanced physiology, developmental biology, and pathophysiology as related to specific disease entities and alterations in functioning.

NURS 804: Pharmacologic Therapy for the Advanced Practice Nurse

3 Credits

Pharmacologic therapies in advanced nursing practice.

NURS 807: Cognitive Behavioral Therapy for Advanced Nursing Practice

2 Credits

This course will focus on the theory and practice of cognitive behavioral therapy. The role of cognitive behavioral concepts in the care and treatment of patients will be reviewed. The care of patients with various diagnoses across different age groups will be explored.

Prerequisite: NURS 810

NURS 808: Population Health Perspectives

3 Credits

This course explores population health concepts, measurement, and application in practice, research, and policy. This course explores population health as a framework for improving health in society. Multiple determinants will be examined in relation to health status measurement, health and disease trends, and health disparities at a community, national, and global perspective. Students will explore models for health improvement and how evidence is utilized in determining population-based intervention and policies directed at health promotion and disease prevention.

NURS 809: Crisis and Trauma-Informed Care for Advanced Nursing Practice

2 Credits

This course will focus on crisis intervention and trauma informed care. The impact of trauma on various populations will be explored. The impact of trauma on neural, cognitive, and behavioral development will be reviewed. Students will learn about and practice current treatment approaches and interventions.

NURS 810: Theoretical Foundation and Application of Psychotherapy with Individuals, Groups, and Families

3 Credits

This course will focus on theory and application of psychotherapy. The role of psychotherapy in the care and treatment of patients will be reviewed. Application of psychotherapy with various diagnoses across different age groups will be explored.

NURS 811: Family and Organizational Systems Across the Lifespan for Advanced Nursing Practice

2 Credits

This course introduces Bowen's family systems theory. The key theoretical concepts will be explored, and students will critically evaluate the self in relation to the family of origin. Students will also utilize critical thinking and self-reflection to apply and integrate these principles to the therapeutic relationship, as well as the care and treatment of individuals and families across the lifespan with a range of different mental health and illness states.

NURS 823: Interventions for Common Health Problems in the Adult/Older Adult

4 Credits

Discussion of common health problems experienced by adults/older adults and development of evidence-based interventions for management.

Prerequisite: NURS 502 , NURS 503 , NURS 804

NURS 824: Primary Palliative Care: An Interdisciplinary Approach

3 Credits/Maximum of 999

This course examines the delivery of primary palliative care from an interdisciplinary perspective. This course examines the delivery of primary palliative care in diverse populations across health care settings. Students will explore the roles of interdisciplinary healthcare professionals in the delivery of care for individuals with advanced serious illness and their family members. A holistic, person-centered approach addressing the physical, psychosocial, cultural, and spiritual delivery of primary palliative care will be examined across the life span.

NURS 825: Primary Palliative Care: Interdisciplinary Management of Advanced Serious Illness

3 Credits/Maximum of 999

This course examines the interdisciplinary management of persons with advanced serious illness and their family members. This course examines the interdisciplinary management of persons with advanced serious illness and their family members. Evidence-based approaches for managing the physical, psychosocial, cultural, and spiritual aspects of person-centered primary palliative care will be discussed. The course will focus on the delivery of high-quality, culturally sensitive, primary palliative care across the life-span with diverse populations in various health care settings. Holistic approaches to management from an interdisciplinary team perspective will be examined

NURS 826: Interdisciplinary Practicum of the Primary Palliative Care Role

3 Credits/Maximum of 999

Interdisciplinary practicum in the synthesis and application of the primary palliative care role. This course involves the practical application of knowledge acquired in previously completed courses related to primary palliative care. Students will have precepted experiences, observations, and simulated experiences to demonstrate multiple aspects of the delivery of primary palliative care. The practicum will be interdisciplinary and include various types of health care settings. The practicum will build upon and extend students' previous experiences with palliative care and fulfill mutually agreed-upon objectives based on the students' previous experiences and identified learning needs.

Prerequisite: NURS 824, NURS 825

NURS 828: Person-Centered Care: Emerging Interdisciplinary Approaches for Older Adults

3 Credits

This course examines the delivery of person-centered care for older adults and their families across the health care continuum. Application of relevant theories will provide a framework of understanding and delivering care which addresses the individual's goals and behavioral

episodes in the context of personal interactions and environmental factors. The importance of assessment and care planning in relation to individuals' context, personal history, and preferences for everyday living will be emphasized, while integrating care related to complex medical problems in older adults. Students will explore interdisciplinary roles, examine case studies, and identify specific interventions. The course will use a holistic approach which addresses the biological, mental/emotional, social/cultural, and spiritual delivery of person centered care to older adults and their families.

NURS 830: Evidence-Based Practice I: Inquiry and Research Methods

3 Credits

Foundations in evidence-based research and inquiry for nursing practice This course will provide students with the skills to incorporate evidence-based research and inquiry into nursing practice.

NURS 831: Evidence-Based Practice II: Translating Inquiry into Practice

3 Credits

Evaluation and translation of evidence-based research and inquiry into nursing practice. This course will provide students will the skills to evaluate evidence-based research in order to translate the research into practice. Students will identify a clinical or practice phenomenon in need of evaluation and change and conduct a systematic search of the research literature.

NURS 832: Doctor of Nursing Practice: Leadership I

3 Credits

Foundations of Doctor of Nursing Practice transformational leadership in complex health care settings.

NURS 833: Doctor of Nursing Practice: Leadership II

3 Credits

Doctor of Nursing Practice transformational leadership to improve healthcare delivery and quality outcomes.

Prerequisite: NURS 832

NURS 834: Doctor of Nursing Practice Clinical Practicum

1-4 Credits/Maximum of 8

The focus of the clinical practicum is planning, implementing, and evaluating evidence-based interventions to address a healthcare problem.

NURS 835: Doctor of Nursing Practice Project

2-3 Credits/Maximum of 10

The Doctor of Nursing Practice capstone project demonstrates clinical scholarship in an area of practice.

NURS 836: Healthcare Informatics

3 Credits

This course provides a foundation in information systems and technology for improvement of healthcare.

Cross-listed with: IST 836

NURS 837: Evidence-Based Practice III: Project Development

3 Credits

The Doctor of Nursing Practice (D.N.P.) project plan will be developed focusing on design, sample, data collection, projected outcomes, resourcing, plan for analysis, and sustainability. Students will collaborate with key stakeholders to build project support. Students will complete steps for Institutional Review Board (IRB) submission. The course includes 75 hours of required clinical practicum hours.

Prerequisite: NURS 830, NURS 831**NURS 840: Nursing Education Theories and Strategies**

3 Credits

Theoretical foundation and evidence-based strategies for nursing education. NURS 840 Nursing Education Theories and Strategies (3) This course provides a foundation in the role of the nurse educator and evidence-based strategies for nursing education. Students will explore various theoretical perspectives of teaching and learning, as well as practical application of strategies to meet the diverse needs of learners. The course is intended to prepare students to employ effective teaching strategies in classroom, clinical, and on-line educational settings. Discussion of managing various challenges related to nursing education will be included throughout the course.

NURS 841: Assessment and Evaluation in Nursing Education

3 Credits

Methods for assessment, measurement, and evaluation of student learning in academic and clinical settings. NURS 841 Assessment and Evaluation in Nursing Education (3) This course provides a foundation in assessment, measurement, and evaluation strategies for nursing education. Students will explore the theoretical basis for evaluation, as well as practical application of the strategies. The course is intended to prepare students to utilize strategies of measurement and evaluation in developing tests, interpreting test results, assessing clinical performance, and evaluating written assignments. Discussion of legal and ethical issues related to evaluation in nursing education will be included throughout the course.

NURS 842: Curriculum and Program Development in Nursing Education

3 Credits

Curriculum design and evaluation, educational program development, and accreditation. NURS 842 Curriculum and Program Development in Nursing Education (3) This course provides a foundation in curricular design, program development, and curriculum evaluation in nursing education. Students will explore internal and external contextual factors influencing curriculum design and implementation. This course is intended to prepare students to utilize foundational principles and concepts for the development and evaluation of nursing curricula in academic settings. This course will also prepare students for program development and evaluation in nursing education.

NURS 843: Synthesis and Application of the Nurse Educator Role

3-6 Credits/Maximum of 6

This capstone practicum course involves the practical application of knowledge from previously completed courses related to the nurse educator role and advanced nursing care delivery in academic

and healthcare settings. Students will work with a preceptor in an educational/healthcare settings to demonstrate multiple aspects of the nurse educator role. In addition, students will demonstrate a direct care role through clinical experiences designed to strengthen patient care delivery skills. The practicum experiences will be developed to fulfill mutually agreed-upon objectives based on students' previous experiences and identified learning needs.

Prerequisite: NURS 840, NURS 841, NURS 842**NURS 845: Healthcare Economics and Policy for Nurse Administrators**

3 Credits

Concepts of healthcare economics and policy for nurse administrators

NURS 846: Leadership Concepts and Theories for Nurse Administrators

3 Credits

Concepts and theories of leadership for nurse administrators. NURS 846 Leadership Concepts and Theories for Nurse Administrators (3) This course provides a foundation in nurse leadership roles, concepts, and theories. Students will explore the theoretical basis of leadership and change, as well as analyze organizational structure, power, and politics. This course is intended to provide students with a theoretical and evidence-based foundation for leadership roles within health care organizations. Discussion of communication, decision-making, and problem-solving strategies for nurse administrators is included throughout the course.

NURS 847: Human Resource and Work Force Issues for Nurse Administrators

3 Credits

Human resource management and work force issues for nurse administrators. NURS 847 Human Resource and Work Force Issues for Nurse Administrators (3) This course provides a foundation in human resources within health care organizations. Students will examine ethical and legal issues related to collective bargaining, unions, and staffing. This course is intended to prepare students to utilize leadership strategies for recruiting, retaining, developing, and evaluating a diverse, multidisciplinary work force in complex healthcare environments. Discussion of evidence-based strategies for conflict resolution will be included throughout the course.

NURS 848: Synthesis and Application of the Nurse Administrator Role

3-6 Credits/Maximum of 6

This course involves the practical application of knowledge acquired in previously completed courses related to nurse administration. Students will work with a preceptor in a health care setting to demonstrate multiple aspects of the nurse administrator role. The practicum experience will be developed to fulfill mutually agreed-upon objectives based on students' previous experiences and identified learning needs.

Prerequisite: NURS 845 ; NURS 846 ; NURS 847**NURS 848A: Synthesis and Application of the Nurse Administrator Role**

4 Credits

This course involves the practical application of knowledge acquired in previously completed courses related to the nurse administrator.

Students will work with a preceptor in a health care setting to demonstrate multiple aspects of the nurse administrator role. The practicum experience will be developed to fulfill mutually agreed-upon objectives based on students' previous experiences and identified learning needs. This course is specifically designed as a practicum course for students in the B.S.N. to D.N.P. program and evaluated based on the nationally acknowledged foundational competencies that are core to all advanced nursing practice roles and known as the D.N.P. Essentials (AACN, 2006).

Prerequisite: NURS 845, NURS 846, NURS 847

NURS 851: General Linear Modeling in Health Research

4 Credits

In this course students will learn the application of general and generalized linear models in health research. Students will learn the process of developing and testing hypotheses including hypotheses testing mediation and moderation. Students will also identify the quantitative and clinical assumptions of models, apply model building techniques, and calculate the appropriate effect sizes. Using common statistical analysis software packages, students will develop the skills needed for interdisciplinary collaborations on research projects using these models.

Prerequisite: STAT 500 or PHS 520 or HDFS 519 or EDPSY 406

NURS 860: Adult Gerontology Acute Care Nurse Practitioner Role I

3 Credits/Maximum of 999

Acute Care Nurse Practitioner role across the continuum of care with adults and older adults with complex acute, critical, and chronic health conditions to restore or maximize health. This course focuses on utilization of a collaborative approach to enhance Acute Care Nurse Practitioner effectiveness with restorative care and synthesis of theoretical, scientific, and clinical knowledge required for the assessment, diagnosis, management, and treatment options of patients with complex acute, critical, and chronic illness across the continuum of care. Content will focus on patients with acute and chronic cardiovascular, pulmonary, infectious disease, and nutrition problems, as well as related ethical, legal, and professional practice issues. This course is designed to be taken concurrently with the Adult Gerontology Acute Care Nurse Practitioner Practicum I (NURS 862) and is required for the Adult Gerontology Acute Care Nurse Practitioner Option within the Master of Science degree with a major in Nursing.

Prerequisite: NURS 802 and NURS 803 and NURS 804 and NURS 865 and NURS 866

NURS 861: Adult Gerontology Acute Care Nurse Practitioner Role II

3 Credits

Continuation of Acute Care Nurse Practitioner role across the continuum of care with adults and older adults with complex acute, critical, and chronic health conditions to restore or maximize health. NURS 861 Adult Gerontology Acute Care Nurse Practitioner Role II (3) This course continues the focus on utilization of a collaborative approach to enhance Acute Care Nurse Practitioner effectiveness with restorative care and synthesis of theoretical, scientific, and clinical knowledge required for the assessment, diagnosis, management, and treatment options of patients with complex acute, critical, and chronic illness across the continuum of care. Content will focus on patients with acute and chronic neurologic,

gastrointestinal, renal, hematologic, and endocrine problems, as well as special topics. This course is designed to be taken concurrently with the Adult Gerontology Acute Care Nurse Practitioner Practicum II (NURS 863) and is required for the Adult Gerontology Acute Care Nurse Practitioner Option within the Master of Science degree with a major in Nursing.

Prerequisite: NURS 860 , NURS 862; Concurrent: NURS 863

NURS 862: Adult Gerontology Acute Care Nurse Practitioner Practicum I

4 Credits

Adult Gerontology Acute Care Nurse Practitioner practicum with patients across the continuum of care with adults and older adults with complex acute, critical, and chronic health conditions. This is a comprehensive practicum in which students implement the Adult Gerontology Acute Care Nurse Practitioner role through application of theoretical knowledge and psychomotor skills taught in NURS 860 and all prior courses. Emphasis is given to development of clinical competency and clinical decision making abilities. This practicum course for the Adult Gerontology Acute Care Nurse Practitioner option involves student rotations through clinical sites providing care for adults and older adults with acute and critical illness. Clinical conferences will enable students to discuss their unique clinical experiences and topics that emerge from their clinical practice. Minimum clinical conference time is 15 hours per semester.

Prerequisite: NURS 802 and NURS 803 and NURS 804 and NURS 865 and NURS 866

NURS 862D: Adult Gerontology Acute Care Nurse Practitioner Doctoral Practicum I

3 Credits

This is a comprehensive practicum in which students implement the Adult Gerontology Acute Care Nurse Practitioner role through application of theoretical knowledge and psychomotor skills taught in NURS 860 and all prior courses. This practicum allows the student to integrate the roles of the DNP prepared Adult Gerontology Acute Care Nurse Practitioner, demonstrate clinical competency and clinical decision-making abilities, and contribute to a culture of clinical scholarship among all health care professionals. Clinical experiences are conducted with guidance from a clinical preceptor and clinical faculty oversight. This doctoral practicum course for the Adult Gerontology Acute Care Nurse Practitioner option involves student rotations through clinical sites providing care for adults and older adults with acute and critical illness. Epidemiological, cultural, ethical, and economic factors, plus interprofessional collaborations and quality improvement are explored. Clinical conferences will enable students to discuss their unique clinical experiences and topics that emerge from their clinical practice. Minimum clinical conference time is 15 hours per semester. This clinical practicum course is the first of a three-course sequence in the Adult Gerontology Acute Care Nurse Practitioner program.

NURS 863: Adult Gerontology Acute Care Nurse Practitioner Practicum II

4 Credits

Adult Gerontology Acute Care Nurse Practitioner practicum across the continuum of care with adults and older adults with complex acute, critical, and chronic health conditions. NURS 863 Adult Gerontology Acute Care Nurse Practitioner Practicum II (4) This is a comprehensive practicum in which students implement the Adult Gerontology Acute Care Nurse Practitioner role through application of theoretical knowledge and psychomotor skills taught in NURS 861 and all prior courses. Emphasis is

given to development of clinical competency and clinical decision making abilities. This practicum course for the Adult Gerontology Acute Care Nurse Practitioner option involves student rotations through clinical sites providing care for adults and older adults with acute and critical illness. Student rotations will include both medical and surgical clinical sites by completion of Practicum I and Practicum II. Clinical conferences will enable students to discuss their unique clinical experiences and topics that emerge from their clinical practice. Minimum clinical conference time is 15 hours per semester.

Prerequisite: NURS 860 , NURS 862; Concurrent: NURS 861

NURS 863D: Adult Gerontology Acute Care Nurse Practitioner Doctoral Practicum II

3 Credits

This is a comprehensive practicum in which students implement the Adult Gerontology Acute Care Nurse Practitioner role through application of theoretical knowledge and psychomotor skills taught in NURS 861 and all prior courses. This practicum allows the student to integrate the roles of the DNP prepared Adult Gerontology Acute Care Nurse Practitioner, demonstrate clinical competency and clinical decision-making abilities, and contribute to a culture of clinical scholarship among all health care professionals. Clinical experiences are conducted with guidance from a clinical preceptor and clinical faculty oversight. This doctoral practicum course for the Adult Gerontology Acute Care Nurse Practitioner option involves student rotations through clinical sites providing care for adults and older adults with acute and critical illness. Student rotations will include both medical and surgical clinical sites by completion of Practicum I and Practicum II. Clinical conferences will enable students to discuss their unique clinical experiences and topics that emerge from their clinical practice. Minimum clinical conference time is 15 hours per semester. This clinical practicum course is the second of a three-course sequence in the Adult Gerontology Acute Care Nurse Practitioner program.

NURS 864: Adult Gerontology Acute Care Nurse Practitioner Integrative Practicum

2-6 Credits

Adult Gerontology Acute Care Nurse Practitioner integrative practicum across the continuum of care with adults and older adults with complex acute, critical, and chronic health conditions. NURS 864 Adult Gerontology Acute Care Nurse Practitioner Integrative Practicum (6) This is a comprehensive practicum in which students implement the Adult Gerontology Acute Care Nurse Practitioner role and demonstrate synthesis of theoretical, scientific and contemporary clinical knowledge learned in all courses of the Adult Gerontology Acute Care Nurse Practitioner Option. This practicum allows the student to integrate the roles of the Adult Gerontology Acute Care Nurse Practitioner and demonstrate clinical competency and clinical decision making abilities. The setting for clinical rotation may include any acute or critical care area and may be chosen based on the student's preferred specialty area. Clinical conferences will be utilized to discuss clinical issues identified by students from their specific sites, synthesize all previously learned knowledge, and discuss role development. Minimum clinical conference time is 15 hours per semester.

Prerequisite: NURS 862 , NURS 863

NURS 864D: Adult Gerontology Acute Care Nurse Practitioner Integrative Doctoral Practicum

5 Credits

This is a comprehensive practicum in which students implement the Adult Gerontology Acute Care Nurse Practitioner role and demonstrate synthesis of theoretical, scientific and contemporary clinical knowledge learned in all courses of the Adult Gerontology Acute Care Nurse Practitioner Option. This practicum allows the student to integrate the roles of the DNP prepared Adult Gerontology Primary Care Nurse Practitioner, demonstrate clinical competency and clinical decision-making abilities, and contribute to a culture of clinical scholarship among all health care professionals. Clinical experiences are conducted with guidance from a clinical preceptor and clinical faculty oversight. The setting for clinical rotation may include any acute or critical care area and may be chosen based on the student's preferred specialty area. Clinical conferences will be utilized to discuss clinical issues identified by students from their specific sites, synthesize all previously learned knowledge, and discuss role development. Minimum clinical conference time is 15 hours per semester. This clinical practicum course is the third of a three-course sequence in the Adult Gerontology Acute Care Nurse Practitioner program.

NURS 865: Pharmacology for Acute Care Nurse Practitioners

1 Credits

Principles of clinical pharmacology as applied to management of complex acute, critical, and chronically ill adult and older adult patients. NURS 865 Pharmacology for Acute Care Nurse Practitioners (1) This course focuses on pharmacologic therapies specific to critically ill adult and older adult patients. Emphasis is placed on proper prescribing regimens and monitoring in critical illness. This course is designed to be taken concurrently with Pharmacologic Therapy (NURS 504) and is required for the Adult Gerontology Acute Care Nurse Practitioner Option within the Master of Science degree with a major in Nursing.

NURS 866: Health Assessment of the Adult Gerontology Population in Acute Care

1 Credits

Physical assessment and diagnostics for physical and psychosocial health of adult and older adult individuals and families with acute and critical illness. NURS 866 Health Assessment of the Adult Gerontology Population in Acute Care (1) This foundational course is designed to assist the advanced practice nurse in learning comprehensive assessment of adult and older adult individuals and families with acute and critical illness. Performance and interpretation of related diagnostic tests and procedures is integrated in the course. Emphasis is placed on development of competence to perform a comprehensive health assessment, develop differential diagnosis, and demonstrate diagnostic reasoning in evaluation of acutely and critically ill patients. This course is designed to be taken concurrently with Physical Assessment Across the Lifespan (NURS 502) and is required for the Adult Gerontology Acute Care Nurse Practitioner Option within the Master of Science degree with a major in Nursing. The didactic and laboratory components of the course are offered concurrently to allow for the application of knowledge.

NURS 867: Clinical Practice Synthesis for Adult Gerontology Acute Care Nurse Practitioner

3 Credits

This is a comprehensive didactic and simulation experience in which students implement the Adult Gerontology Acute Care Nurse Practitioner role through application of theoretical knowledge and psychomotor skills. This course involves demonstration of the role in varied online, classroom, and simulation settings including a full week on site intensive.

Prerequisites: NURS 860 or NURS 861 or NURS 862D

NURS 870: Nurse Practitioner Role with Healthy Individuals and Families

3 Credits/Maximum of 999

Nurse Practitioner role to promote health, prevent illness, and manage common acute/episodic health problems across the adult-older adult age spectrum. NURS 870 provides instruction in the Nurse Practitioner role to promote health, prevent illness, and manage common acute/episodic health problems across the adult-older adult population. Common acute/episodic conditions seen in primary care are discussed. Evidence-based management including, but not limited to, assessment, differential diagnoses, current guidelines' treatments, with both pharmacological and nonpharmacological strategies, are included; as are individual, age-related, family, and special population considerations. Epidemiological, cultural, ethical, and economical factors, plus interprofessional collaborations, related to health promotion, disease prevention, and treatment are explored.

Prerequisite: NURS 802 and NURS 803 and NURS 804

NURS 870F: Family Nurse Practitioner Role with Healthy Family/ Individual

3 Credits

This is a comprehensive professional practice course in which students learn the Family/Individual Across the Lifespan Nurse Practitioner (F/ INP) role focused on common acute/episodic health problems in caring for individuals and families across the lifespan. The student will integrate newly acquired and previously mastered knowledge. Emphasis is on the specialized population and role of the F/INP. Content focuses on epidemiological, cultural, ethical, and economic factors related to families and individuals in the context of health promotion, disease prevention, treatment options, and quality improvement processes.

NURS 870M: Neuroscience and Psychobiology of Mental Illness and Across the Lifespan

3 Credits

This course builds on previous knowledge of pathophysiology with a specific focus on neurologic processes and differentiation between normal and abnormal function in acute and chronic illnesses. Students will recognize vulnerabilities in individuals and groups after reviewing etiology, neuroscience, developmental considerations, complications, and clinical manifestations of specific psychiatric disease processes. Individual cases will be introduced to facilitate the analysis of history, signs and symptoms, and laboratory and diagnostic data.

Prerequisite: NURS 803

NURS 871: Nurse Practitioner Role with Individuals and Families with Complex and/or Chronic Health Problems

3 Credits

Nurse Practitioner role with individuals and families to maximize health and manage complex and/or chronic health problems.

Prerequisite: NURS 870 , NURS 872 or NURS 872A; Concurrent: NURS 873or NURS 873A

NURS 871F: Family Nurse Practitioner Role with Individuals and Families with Complex and/or Chronic Health Prob

3 Credits

This is a comprehensive professional practice course in which students learn the Family/Individual Across the Lifespan Nurse Practitioner (F/ INP) role focused on the identification and management of complex and/or chronic health problems in caring for individuals and families across the lifespan. The student will integrate newly acquired and previously mastered knowledge. Emphasis is on the specialized population and role of the F/INP with complex and/or chronic health problems. Content focuses on epidemiological, cultural, ethical, and economic factors related to families and individuals in the context of disease recognition, diagnoses, treatment options, and quality improvement processes.

NURS 871M: Neuropsychopharmacology and Biologically Based Treatments Across the Lifespan

3 Credits

This course expands upon the student's prior pharmacology foundation to focus on the principles of neuropsychopharmacology and biologically based treatments. These principles are applied to the care and treatment of individuals and families across the lifespan with a range of different mental health and illness states. Epidemiological, cultural, ethical, social, and economic factors, plus inter-professional collaboration, related to health promotion, disease prevention, and treatment are explored. In addition, proper prescribing and monitoring procedures for the various treatments are reviewed, along with considerations for specific populations across the lifespan.

Prerequisite: NURS 803 and NURS 804

NURS 872: Family Nurse Practitioner Practicum I

3 Credits

Family Nurse Practitioner practicum with individuals and families across the life span experiencing common acute/episodic health problems. This is a comprehensive practicum in which students implement the Family Nurse Practitioner (FNP) role through application of theoretical knowledge and psychomotor skills taught in all prior courses. Emphasis is given to development of clinical competency and clinical decision-making abilities with guidance from a clinical preceptor and clinical faculty oversight. This practicum course involves student rotations through clinical sites providing care for individuals and families across the lifespan experiencing common acute/episodic health problems. Epidemiological, cultural, ethical, and economic factors, plus inter-professional collaborations, related to health promotion, disease prevention, and treatment are explored. Clinical conferences will enable students to discuss their unique clinical experiences and topics that emerge from their clinical practice.

Prerequisite: NURS 802 and NURS 802A and NURS 803 and NURS 804
CONCURRENT: NURS 870 and NURS 875

NURS 872A: Adult Gerontology Primary Care Nurse Practitioner Practicum I

4 Credits

AGPC NP practicum with individuals and families across the adult/older adult age spectrum experiencing common acute/episodic health problems. This is a comprehensive practicum in which students implement the Adult Gerontology Primary Care Nurse Practitioner role through application of theoretical knowledge and psychomotor skills taught in all prior courses. Emphasis is given to development of clinical competency and clinical decision-making abilities with guidance from a clinical preceptor and clinical faculty oversight. This practicum course involves student rotations through clinical sites providing care for individuals and families across the adult/older adult age spectrum experiencing common acute/episodic health problems. Epidemiological, cultural, ethical, and economic factors, plus inter-professional collaborations, related to health promotion, disease prevention, and treatment are explored. Clinical conferences will enable students to discuss their unique clinical experiences and topics that emerge from their clinical practice.

Prerequisite: NURS 802 and NURS 803 and NURS 804

NURS 872D: Adult Gerontology Primary Care Nurse Practitioner Doctoral Practicum I

3 Credits

This is a comprehensive practicum in which students implement the Adult Gerontology Primary Care Nurse Practitioner role through application of theoretical knowledge and psychomotor skills taught in all prior courses. This practicum allows the student to integrate the roles of the DNP prepared Adult Gerontology Primary Care Nurse Practitioner, demonstrate clinical competency and clinical decision-making abilities, and contribute to a culture of clinical scholarship among all health care professionals. Clinical experiences are conducted with guidance from a clinical preceptor and clinical faculty oversight. This doctoral practicum course involves student rotations through clinical sites providing care for individuals and families across the adult/older adult age spectrum experiencing common acute/episodic health problems. Epidemiological, cultural, ethical, and economic factors, plus inter-professional collaborations, related to health promotion, disease prevention and treatment, and quality improvement are explored. Clinical conferences will enable students to discuss their unique clinical experiences and topics that emerge from their clinical practice. This clinical practicum course is the first of a three-course sequence in the Adult Gerontology Primary Care Nurse Practitioner program.

NURS 872F: Family/Individual Across the Lifespan Nurse Practitioner Doctoral Practicum I

2 Credits

This is a comprehensive practicum in which students implement the Family/Individual Across the Lifespan Nurse Practitioner (F/INP) role through application of theoretical knowledge and psychomotor skills taught in all prior courses. This practicum allows the student to integrate the roles of the DNP prepared F/INP, demonstrate clinical competency and clinical decision-making abilities, and contribute to a culture of clinical scholarship among all health care professionals. Clinical

experiences are conducted with guidance from a clinical preceptor and clinical faculty oversight. This doctoral practicum course involves student rotations through clinical sites providing care for individuals and families across the lifespan experiencing common acute/episodic health problems. Epidemiological, cultural, ethical, and economic factors, plus inter-professional collaborations, related to health promotion, disease prevention, and treatment, and quality improvement are explored. Clinical conferences will enable students to discuss their unique clinical experiences and topics that emerge from their clinical practice. This clinical practicum course is the first of a three-course sequence in the Family/Individual Across the Lifespan Nurse Practitioner program.

NURS 872M: Psychiatric Mental Health Across the Lifespan Nurse Practitioner Doctoral Practicum I

3 Credits

This is a comprehensive practicum in which students implement the Psychiatric Mental Health Across the Lifespan Nurse Practitioner (PMHNP) role through application of theoretical knowledge and psychotherapeutic skills taught in all prior courses. This practicum allows the student to integrate the roles of the DNP prepared PMHNP, demonstrate clinical competency and clinical decision-making abilities, and contribute to a culture of clinical scholarship among all health care professionals. Clinical experiences are conducted with guidance from a clinical preceptor and clinical faculty oversight. This doctoral practicum course involves student rotations through clinical sites providing care for individuals and families across the lifespan experiencing psychiatric mental health problems. Epidemiological, cultural, ethical, and economic factors, plus inter-professional collaborations, related to health promotion, disease prevention, treatment, and quality improvement are explored. Clinical conferences will enable students to discuss their unique clinical experiences and topics that emerge from their clinical practice. This clinical practicum course is the first of a three-course sequence in the Psychiatric Mental Health Across the Lifespan Nurse Practitioner program.

Prerequisite: NURS 870M and NURS 871M

NURS 873: Family Nurse Practitioner Practicum II

4 Credits

Family Nurse Practitioner practicum with individuals and families across the life span experiencing complex and/or chronic health problems.

Prerequisite: NURS 870 , NURS 872 NURS 875 , NURS 876; Concurrent: NURS 871

NURS 873A: Adult Gerontology Primary Care Nurse Practitioner Practicum II

4 Credits

Adult Gerontology Primary Care Nurse Practitioner practicum with individual/families across the adult/older adult age spectrum experiencing complex and/or chronic health problems.

Prerequisite: NURS 870 , NURS 872A; Concurrent: NURS 871

NURS 873D: Adult Gerontology Primary Care Nurse Practitioner Doctoral Practicum II

3 Credits

This is a comprehensive practicum in which students implement the Adult Gerontology Primary Care Nurse Practitioner role through application of theoretical knowledge and psychomotor skills taught in all prior courses. This practicum allows the student to integrate the roles of the DNP prepared Adult Gerontology Primary Care Nurse Practitioner, demonstrate clinical competency and clinical decision-making abilities, and contribute to a culture of clinical scholarship among all health care professionals. Clinical experiences are conducted with guidance from a clinical preceptor and clinical faculty oversight. This doctoral practicum course involves student rotations through clinical sites providing care for individuals and families across the adult/older adult age spectrum experiencing common acute/episodic health problems. Epidemiological, cultural, ethical, and economic factors, plus inter-professional collaborations, related to health promotion, disease prevention and treatment, and quality improvement are explored. Clinical conferences will enable students to discuss their unique clinical experiences and topics that emerge from their clinical practice. This clinical practicum course is the second of a three-course sequence in the Adult Gerontology Primary Care Nurse Practitioner program.

NURS 873F: Family/Individual Across the Lifespan Nurse Practitioner Doctoral Practicum II

3 Credits

This is a comprehensive practicum in which students implement the Family/Individual Across the Lifespan Nurse Practitioner (F/INP) role through application of theoretical knowledge and psychomotor skills taught in all prior courses. This practicum allows the student to integrate the roles of the DNP prepared F/INP, demonstrate clinical competency and clinical decision-making abilities, and contribute to a culture of clinical scholarship among all health care professionals. Clinical experiences are conducted with guidance from a clinical preceptor and clinical faculty oversight. This doctoral practicum course involves student rotations through clinical sites providing care for individuals and families across the lifespan experiencing common acute/episodic health problems. Epidemiological, cultural, ethical, and economic factors, plus inter-professional collaborations, related to health promotion, disease prevention, and treatment, and quality improvement are explored. Clinical conferences will enable students to discuss their unique clinical experiences and topics that emerge from their clinical practice. This clinical practicum course is the second of a three-course sequence in the Family/Individual Across the Lifespan Nurse Practitioner program.

NURS 873M: Psychiatric Mental Health Across the Lifespan Nurse Practitioner Doctoral Practicum II

3 Credits

This is a comprehensive practicum in which students implement the Psychiatric Mental Health Across the Lifespan Nurse Practitioner (PMHNP) role through application of theoretical knowledge and psychotherapeutic skills taught in all prior courses. This practicum allows the student to integrate the roles of the DNP prepared PMHNP, demonstrate clinical competency and clinical decision-making abilities, and contribute to a culture of clinical scholarship among all health care professionals. Clinical experiences are conducted with guidance from a clinical preceptor and clinical faculty oversight. This doctoral practicum course involves student rotations through clinical sites providing care

for individuals and families across the lifespan experiencing psychiatric and mental health problems. Epidemiological, cultural, ethical, and economic factors, plus inter-professional collaborations, related to health promotion, disease prevention, and treatment, and quality improvement are explored. Clinical conferences will enable students to discuss their unique clinical experiences and topics that emerge from their clinical practice. This clinical practicum course is the second of a three-course sequence in the Psychiatric Mental Health Across the Lifespan Nurse Practitioner program.

Prerequisite: NURS 872M

NURS 874: Family Nurse Practitioner Integrative Practicum

2-6 Credits

Family Nurse Practitioner integrative practicum with communities and individuals/families across the life span experiencing health and illness.

Prerequisite: NURS 871 , NURS 873

NURS 874A: Adult Gerontology Primary Care Nurse Practitioner Integrative Practicum

2-6 Credits

Adult Gerontology Primary Care Nurse Practitioner integrative practicum with communities and individuals/families experiencing health and illness.

Prerequisite: NURS 871 , NURS 873A

NURS 874D: Adult Gerontology Primary Care Nurse Practitioner Integrative Doctoral Practicum

5 Credits

This is a comprehensive practicum in which students implement the Adult Gerontology Primary Care Nurse Practitioner role through application of theoretical knowledge and psychomotor skills taught in all prior courses. This practicum allows the student to integrate the roles of the DNP prepared Adult Gerontology Primary Care Nurse Practitioner, demonstrate clinical competency and clinical decision-making abilities, and contribute to a culture of clinical scholarship among all health care professionals. Clinical experiences are conducted with guidance from a clinical preceptor and clinical faculty oversight. This doctoral practicum course involves student rotations through clinical sites providing care for individuals and families across the adult/older adult age spectrum experiencing common acute/episodic health problems. Epidemiological, cultural, ethical, and economic factors, plus inter-professional collaborations, related to health promotion, disease prevention and treatment, and quality improvement are explored. Clinical conferences will enable students to discuss their unique clinical experiences and topics that emerge from their clinical practice. This clinical practicum course is the third of a three-course sequence in the Adult Gerontology Primary Care Nurse Practitioner program.

NURS 874F: Family/Individual Across the Lifespan Nurse Practitioner Integrative Doctoral Practicum

5 Credits

This is a comprehensive practicum in which students implement the Family/Individual Across the Lifespan Nurse Practitioner (F/INP) role through application of theoretical knowledge and psychomotor skills taught in all prior courses. This practicum allows the student to integrate

the roles of the DNP prepared F/INP, demonstrate clinical competency and clinical decision-making abilities, and contribute to a culture of clinical scholarship among all health care professionals. Clinical experiences are conducted with guidance from a clinical preceptor and clinical faculty oversight. This doctoral practicum course involves student rotations through clinical sites providing care for individuals and families across the lifespan experiencing common acute/episodic health problems. Epidemiological, cultural, ethical, and economic factors, plus inter-professional collaborations, related to health promotion, disease prevention and treatment, and quality improvement are explored. Clinical conferences will enable students to discuss their unique clinical experiences and topics that emerge from their clinical practice. This clinical practicum course is the third of a three-course sequence in the Family/Individual Across the Lifespan Nurse Practitioner program.

NURS 874M: Psychiatric Mental Health Across the Lifespan Nurse Practitioner Integrative Doctoral Practicum

5 Credits

This is a comprehensive practicum in which students implement the Psychiatric Mental Health Across the Lifespan Nurse Practitioner (PMHNP) role through application of theoretical knowledge and psychotherapeutic skills taught in all prior courses. This practicum allows the student to integrate the roles of the DNP prepared PMHNP, demonstrate clinical competency and clinical decision-making abilities, and contribute to a culture of clinical scholarship among all health care professionals. Clinical experiences are conducted with guidance from a clinical preceptor and clinical faculty oversight. This doctoral practicum course involves student rotations through clinical sites providing care for individuals and families across the lifespan experiencing psychiatric health problems. Epidemiological, cultural, ethical, and economic factors, plus inter-professional collaborations, related to health promotion, disease prevention and treatment, and quality improvement are explored. Clinical conferences will enable students to discuss their unique clinical experiences and topics that emerge from their clinical practice. This clinical practicum course is the third of a three-course sequence in the Psychiatric Mental Health Across the Lifespan Nurse Practitioner program.

Prerequisite: NURS 873M

NURS 875: Nurse Practitioner Role with Children and Families

2 Credits

Nurse Practitioner role with children and their families to promote health, prevent illness, and manage acute or chronic health problems. NURS 875 provides instruction in the Nurse Practitioner role with children and their families to promote health, plan anticipatory guidance, conduct health screenings, prevent illness, and manage primary care health problems. Evidence-based management including, but not limited to, assessment, differential diagnoses, current guidelines' treatments, with both pharmacological and nonpharmacological strategies, are included; as are individual, age-related, family, and special population considerations. Epidemiological, cultural, ethical, and economical factors, plus interprofessional collaborations related to health promotion, disease prevention, and treatment are explored.

Prerequisite: NURS 802 and NURS 802A and NURS 803 and NURS 804
CONCURRENT: NURS 876

NURS 876: Family Nurse Practitioner Practicum with Pediatric Populations

2 Credits

Family Nurse Practitioner practicum with pediatric populations/families during health or experiencing acute and chronic health problems. NURS 876 provides instruction in the Nurse Practitioner role with children and their families to promote health, plan anticipatory guidance, conduct health screenings, prevent illness, and manage primary care health problems. Evidence-based management including, but not limited to, assessment, differential diagnoses, current guidelines' treatments, with both pharmacological and nonpharmacological strategies, are included; as are individual, age-related, family, and special population considerations. Epidemiological, cultural, ethical, and economical factors, plus interprofessional collaborations related to health promotion, disease prevention, and treatment are explored.

Prerequisite: NURS 802 and NURS 802A and NURS 803 and NURS 804
CONCURRENT: NURS 870 and NURS 872 and NURS 875

NURS 876F: Family/Individual Across the Lifespan Nurse Practitioner Doctoral Practicum in Child Health

1 Credits

This is a comprehensive practicum in which students implement the Family/Individual Across the Lifespan Nurse Practitioner (F/INP) role with the pediatric population through application of theoretical knowledge and psychomotor skills taught in all prior courses. This practicum allows the student to integrate the roles of the DNP prepared F/INP, demonstrate clinical competency and clinical decision-making abilities with the pediatric population, and contribute to a culture of clinical scholarship among all health care professionals. Clinical experiences are conducted with guidance from a clinical preceptor and clinical faculty oversight. This doctoral practicum course involves student rotations through clinical sites providing care for pediatric populations/families experiencing acute/episodic and chronic health problems, Epidemiological, cultural, ethical, and economical factors, plus interprofessional collaborations, related to health promotion, anticipatory guidance, disease prevention, treatment, and quality improvement are explored. Clinical conferences will enable students to discuss their unique clinical experiences and topics that emerge from their clinical practice.

Prerequisites: NURS 802A or NURS 875 **Concurrents:** NURS 872F

NURS 877: Clinical Practice Synthesis for Adult Gerontology Primary Care Nurse Practitioner

3 Credits

This is a comprehensive didactic and simulation experience in which students implement the Adult Gerontology Primary Care Nurse Practitioner role through application of theoretical knowledge and psychomotor skills. This course involves demonstration of the role in varied online, classroom, and simulation settings including a full week on site intensive.

Prerequisites: NURS 870 or NURS 871 or NURS 872D

NURS 877F: Clinical Practice Synthesis for Family/Individual Across the Lifespan Nurse Practitioner

3 Credits

This is a comprehensive didactic and simulation experience in which students implement the Family/Individual Across the Lifespan Nurse Practitioner (F/INP) role through application of theoretical knowledge and psychomotor skills. This course involves demonstration of the role in varied online, classroom, and simulation settings including a full week on site intensive.

Prerequisites: NURS 870 or NURS 871 or NURS 875 or NURS 872F or NURS 876F

NURS 877M: Clinical Practice Synthesis for Psychiatric Mental Health Across the Lifespan Nurse Practitioner

3 Credits

This is a comprehensive didactic and simulation experience in which students implement the Psychiatric Mental Health Across the Lifespan Nurse Practitioner (PMHNP) role through application of theoretical knowledge and psychotherapeutic skills. This course involves demonstration of the role in varied online, classroom, and simulation settings including a full week on site intensive.

Prerequisite: NURS 870M and NURS 871M and NURS 872M

NURS 887: Ethics in Professional Nursing Practice

1 Credits

This course provides the theoretical and practical knowledge needed to address ethics issues encountered in nursing practice and to ethically conduct quality improvement initiatives.

NURS 897: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject with a professional orientation.

Nutrition (NUTR)

NUTR 501: Regulation of Nutrient Metabolism I

4 Credits

Integration of nutritional, biomedical, biochemical, physiological, and hormonal processes involved in carbohydrate, lipid, and protein metabolism.

Prerequisite: NUTR 445

NUTR 502: Regulation of Nutrient Metabolism II

3 Credits

Complementary to NUTR 501 with an emphasis on metabolic roles of vitamin and mineral elements.

Prerequisite: NUTR 446

NUTR 503: Nutritional Epidemiology

3 Credits

This course will provide the foundation for understanding Nutritional Epidemiology with a particular focus on theoretical and practical consideration in the design of studies and analysis of dietary data. The material has a strong methodological emphasis, and students are expected to gain a critical understanding of the design, conduct, analysis and interpretation of nutritional epidemiologic studies. The relationship between diet and health outcomes will be thoroughly discussed.

Prerequisites: PHS 554

Cross-listed with: PHS 503

NUTR 504: Behavioral Nutrition

3 Credits

The world is experiencing a nutrition transition as an increasing number of countries rise from poverty. Globally, chronic disease rates continue to increase while rates of undernutrition, including micronutrient deficiencies, stunting, and wasting, remain persistently high. To attenuate all forms of malnutrition across contexts, we need to understand how and why people make choices about the foods they eat so that effective, theory-based interventions can be designed to improve diet and reduce malnutrition risk. This course in behavioral nutrition investigates the bidirectional relationship between eating behaviors and nutrition, with particular emphasis on developing theoretical foundations for how research is conducted and disseminated in this discipline. This course will build an awareness of the many social, environmental, and individual differences that influence the brain and related eating behaviors. At the end of this course, students will be able to recognize and identify the foundational principles of behavioral nutrition and apply these to the design of scientific experiments. They will also be able to apply the principles learned in this course to the design of interventions and programs to change nutrition behaviors.

Recommended Preparation: Prior undergraduate coursework in nutrition, human development, psychology, neuroscience, biobehavioral health, public health, or basic sciences. Demonstrated ability to critically synthesize information at the graduate level.

NUTR 506: Ruminology

3 Credits

Physiological, biochemical, and microbiological activities occurring within the rumen and the relation of rumen function to animal response.

Prerequisite: at least one course in each of the following areas: animal nutrition, physiology, microbiology, and biochemistry
Cross-listed with: ANSC 506

NUTR 508: Critical Readings in Molecular Nutrition

1.5 Credits/Maximum of 6

Understanding of approaches, methods and current concepts in molecular biology and nutrition through critical readings of current primary literature.

Concurrent: NUTR 445 or NUTR 446

Cross-Listed

NUTR 511: Maternal and Child Nutrition

3 Credits

Role of nutrition in female fertility, during pregnancy and lactation, as well as during infancy and early childhood. NUTR 511 Maternal and Child Nutrition (3) This course is designed to provide an understanding of the nutritional recommendations during preconception, pregnancy, lactation, early infancy, and childhood. In this course, students will acquire a broad understanding of the role and regulation of nutrient metabolism and effects of genetic variation on nutritional needs during these unique physiological periods. These concepts will be discussed from molecular, clinical and applied perspectives that will guide further graduate-level inquiry. Lectures and readings will explicate 1) how nutrient metabolism affects pregnancy outcomes, lactation sufficiency and infant development; 2) how nutrition affects common early childhood conditions, such as obesity, allergy and autism; 3) how fetal/postnatal nutrition affects long-term health; and 4) the role of genetics in nutritional requirements during these times in the lifecycle. Students will gain an appreciation for the contribution of nutrition during the fetal/postnatal periods on long-term health and the incidence of disease through understanding the role of nutrients in a translational framework.

NUTR 513: Atherosclerosis and Nutrition

2 Credits

The etiology and pathophysiology of atherosclerotic cardiovascular disease, with emphasis on nutritionally-related aspects.

Prerequisite: NUTR 452

NUTR 515: Mathematical Modeling in Nutrition

2 Credits

Study of the theory and application of mathematical modeling of the tracer and tracee kinetics of nutrients and their metabolites in animals and man.

Prerequisite: MATH 140 or MATH 141

NUTR 520: Readings in Nutrition

1 Credits/Maximum of 2

Readings and reports of selected topics in nutrition.

NUTR 532: Childhood Obesity

3 Credits

This course addresses how genetic predispositions, behavioral and environmental factors affect children's obesity risk and examines strategies for obesity prevention. HDFS (NUTR) 532 Childhood Obesity (3) This course will examine the epidemic of obesity, particularly childhood obesity, and how various behavioral and environmental factors place children at risk of becoming overweight. Sources of influence that will be examined include: children's nutrition and physical activity behaviors, the family environment, the school environment and community characteristics. Media, social policy and economic factors will also be addressed. In addition, the health and psychosocial consequences of obesity, ethnic and socioeconomic disparities in the prevalence and predictors of obesity among children and adolescents will be addressed.

At its conclusion, this course will examine policy initiatives and obesity prevention programs.

Cross-listed with: HDFS 532

NUTR 533: Adult Obesity

3 Credits

Important current and emerging topics in obesity research relevant to government policy and general public education; emphasis on adult obesity. HD FS (NUTR) 533 Adult Obesity (3) This course will examine the epidemic of obesity, particularly adult obesity. Obesity: Causes, Consequences and Treatment will provide a forum to introduce and discuss current and emerging topics in adult obesity research, with emphasis on policy, prevention and treatment. Focus will be given to determinants of adult obesity and translation into government policy and efforts to educate the general public on the most effective strategies for body weight regulation, obesity prevention and treatment. Sources of influence that will be examined include: environment, genetics, neural, peripheral and sensory mechanisms, food properties and food supply, and therapies and treatment of adult obesity.

Cross-listed with: HDFS 533

NUTR 534: Readings in Ingestive Behavior

1 Credits/Maximum of 6

Students lead discussions of original research in the field of ingestive behavior; focus on food intake in particular. FDSC 534 / NUTR 534 Readings in Ingestive Behavior (1 per semester/maximum of 6) The class provides a forum for students to learn to lead a discussion focused on original research in the field of ingestive behavior. In addition, it provides the opportunity for students to become familiar with the broad range of topics relevant to this field of research. While the primary focus is on the consumption of food, other relevant topics (obesity, eating disorders, fluid intake) also are included. Research topics include both basic and applied areas.

Cross-listed with: FDSC 534

NUTR 540: Research Methods

3 Credits/Maximum of 999

Review of different studies that utilize various nutrition research designs and data analyses. This course will provide information on how to evaluate the scientific literature and will promote the development of skills to enable students to identify the strengths and limitations of different types of experimental approaches (epidemiologic, etc.), individual studies, and a body of literature on a specific nutrition-related topic. The importance of generating hypotheses and testing them will be emphasized. The Bradford Hill criteria for evaluating a body of literature and making causal inferences will be utilized. In addition, development and use of the Evidence Analysis Library for making nutrition policy decisions will be discussed. The course will focus on major contemporary nutrition topics undergoing scientific inquiry. The review of a body of literature, as well as a single study in a practice setting will take place throughout the course. The knowledge gained in reviewing and critiquing the scientific literature will be applied to the preparation of a proposal for students' Capstone Project.

Prerequisite: NUTR 850, STAT 500

NUTR 551: Seminar in Nutrition

1-6 Credits/Maximum of 6

Selected topics and recent advances in nutrition.

NUTR 583: Nutritional Epidemiology

3 Credits

Epidemiological principles and methodology to study nutritional determinants of disease.

Prerequisite: NUTR 445 , NUTR 446 and 6 credits of statistics or concurrent

NUTR 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

NUTR 595: **SPECIAL TOPICS**

1-6 Credits

NUTR 595A: Application of Community Nutrition -- Internship

3 Credits

Application and integration of community nutrition theories in a practicum environment under the supervision of preceptors in community agencies.

Prerequisite: selection into the Dietetic Internship Program

NUTR 595B: Application of Food Service Management -- Internship

3 Credits

Application and integration of food service management principles and motivation theories in a practicum environment under the supervision of preceptor.

NUTR 595C: Dietetic Enrichment Experience - Dietetic Internship

1 Credits

The enrichment experience is designed for interns to plan and implement a rotation of interest in the nutrition field.

Prerequisite: NUTR 595A , NUTR 595B , NUTR 595D , or NUTR 595E

NUTR 595D: Application Clinical Nutrition -- Internship

6 Credits

Application and integration of clinical nutrition theories in a practicum environment under the supervision of preceptor who is a registered dietitian.

NUTR 595E: Introduction to Nutrition Research -- Internship

1 Credits

Introduction of nutrition research to assist in the understanding of planning and conducting research studies in a variety of nutrition research laboratories.

NUTR 595F: Professional Portfolio Internship

1 Credits

Designing and completing a professional portfolio to assist in the employment process in the field of dietetics.

NUTR 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

NUTR 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

NUTR 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

NUTR 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

NUTR 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Provides an opportunity for a supervised and graded experience for graduate students in teaching undergraduate courses in nutrition.

NUTR 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

NUTR 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

NUTR 800: Food Systems and Organization Management

3 Credits

This course provides an opportunity to acquire an in-depth knowledge of food systems management and develop the skills necessary to guide practice in the management and leadership of food and nutrition service operations. Students will develop the skills to apply principles of organization management to achieve operational goals and manage financial, human, material, and physical resources in the area of food service and clinical management care. Skills that are emphasized include: collaboration, critical thinking, effective communication, professional conduct, decision-making, planning, time management, and training. Management and leadership are key components of quality food and

nutrition services and effective practice in the field of nutrition and dietetics.

RECOMMENDED PREPARATIONS: Admission to the online Integrated Studies track of the Master of Professional Studies in Nutritional Sciences or departmental approval.

NUTR 801: Leadership in the Nutrition Profession

2 Credits

This course provides an opportunity for students to become proficient in the skills essential for effective leadership within the nutrition field. We will utilize evidence-based tools designed for self-assessment of leadership traits and strengths. Students will practice and develop competency in the skills of negotiation, collaboration and persuasion, intercultural communication and motivation, visioning, and ethical decision-making. The importance of work-life balance and personal boundaries will be examined in the context of today's work environment.

NUTR 805: Advanced Nutrient Metabolism

4 Credits

Integration of biochemical, physiological, and hormonal processes involved in nutrient metabolism and function in humans. NUTR 805 provides the student with both a review of the fundamentals of nutrient metabolism but also more advanced topics in the biochemistry, physiology, metabolism, and regulation of nutrients important in health and disease. At this advanced level, students develop an understanding of the integration and interdependency of many of these metabolic processes. There will be an initial review of cellular structure and function and the basics of organ systems, followed by the physiology and microbiology of the gastrointestinal (GI) tract related to nutrient processing, including the impact of dietary fibers on GI function. For each nutrient, the following topics will be covered: food sources and/or dietary considerations; chemical structure and characteristics; and regulation of digestion, absorption, and excretion. Water, macronutrient (carbohydrate, protein, and lipids), and micronutrient (vitamins and minerals) metabolism, function, and regulation will be presented. For some select nutrients of public health concern, the metabolic mechanisms of deficiency and/or toxicity will be discussed. Metabolic integration relevant to nutritional needs and biomedical applications will be highlighted in this course. Students will apply their knowledge to current biomedical situations relevant to nutrition and health professionals. This course prepares students for the advanced courses in assessment and clinical nutrition.

NUTR 810: Nutritional Assessment and Diagnosis

3 Credits

Evaluation of assessment methods and interpretation of results to assess and diagnose nutritional status of individuals and groups. This course will offer a critical analysis of assessment methods used in clinical, community, and home-based settings to diagnose malnutrition and other nutrition-related problems. Students will become proficient at identifying appropriate current techniques and technologies for collecting assessment data, interpreting the results of the collected data, and diagnosing nutrition problems for specific populations. Specific skills such as nutrition-focused physical examination, identifying and applying appropriate assessment data collection methods, interpreting laboratory values and genetic tests, etc., will be integrated by the student through hands-on experience and case study development. The course focus

will be on advanced skill development, critical analysis of assessment methods and interpretation of the data, and communicating the findings to health care professionals and patients/clients in a variety of workplace settings.

NUTR 820: Advanced Clinical Nutrition

3 Credits

Advanced study of acute and chronic illnesses and conditions and how these events influence the nutritional needs of patients. This class provides an opportunity for students to become proficient in the skills essential to advanced clinical nutrition practice. We will examine the metabolic demands of acute and chronic illness and conditions and how these influence the nutritional needs of patients in various disease states. Interrelationships of nutrition with biochemical, physiological, and anatomical changes associated with acute illness or injury, chronic disease, terminal illness, surgery, and trauma will be covered. Students will utilize an evidence-based approach to assessing nutrient requirements and determine best methods of nutrient delivery in various disease states. The ultimate goal of the course is to develop the skills necessary for advanced clinical nutrition practice.

NUTR 825: Nutrient and Energy Assessment for Performance

3 Credits

This course will provide an in-depth understanding of the assessment process for nutrient and energy availability and use for performance science. Students will practice using multiple tools to assess individual and group nutrient and energy needs for performance. Using the nutrition care process, students will practice reviewing biomarkers and acceptable values, and create diet interventions to improve performance. Students will share results and intervention plans with interprofessional teams.

NUTR 826: Maximizing Performance Through Nutrition and Other Supplements

3 Credits

In this course, the students will learn how to interpret biomarkers and explain the results to student athletes and others in performance-based settings, provide intervention ideas through fueling and supplementation, and review vitamin compliance evidence. The students will also be able to explain how to review ergogenic aids, and how to recommend third-party tested supplementations and education around specific ergogenic aids. Lastly, students will be able to understand and compare the NCAA and other governing bodies' rules and regulations around permissible, impermissible, and banned supplements to a variety of rules and regulations of governing bodies.

NUTR 827: Performance Nutrition for Special Populations and Dietary Patterns

3 Credits

This course will provide insight to performance nutrition fueling strategies covering special populations in athletics and performance (e.g., specific teams, those with special diets, and other groups). This course will provide the students with insights on a variety of special populations seen in the human performance space as well as practice implementing the nutrition care process to provide optimal fueling for performance that fall within special population parameters.

NUTR 830: Advanced Nutrition and Health Program Planning

3 Credits

This course provides an opportunity for students to become proficient in the skills essential for successful nutrition education programming, dissemination, and evaluation through development and implementation of a nutrition education intervention with a target audience in their respective communities. We will examine current theories, models, and state-of-the-art strategies, and discuss how to apply them to a variety of settings including clinical, community, and other workplaces, as well as the home. Various behavioral and environmental factors, which may contribute to the maintenance of poor nutritional outcomes, will be critically assessed. Focus will be on how to plan interventions that address multiple components within the target populations environment. Students will gain proficiency by working in groups and using best practices to design, implement, and evaluate an educational program within their chosen community.

NUTR 840: Advanced Nutrition Counseling

3 Credits

Application of theories and counseling techniques to the nutrition care process in different practice settings with diverse patients/clients. This class provides an opportunity for students to become proficient in the skills essential to successful nutrition counseling. We will examine current theories and state-of-the-art techniques of counseling, and apply them to a variety of settings including clinical, community, workplace, and home-based. Various behavioral and environmental factors, which may contribute to the maintenance of poor nutritional outcomes, will be critically assessed focusing on advanced skill development and the ability to handle challenging communication issues that arise within the nutrition care process. Students will gain proficiency through practicing techniques including client-centered counseling methods, motivational interviewing, and behavior change strategies, as well as principles of group counseling, facilitation, and effective team dynamics. Best practices for those with chronic diseases, obesity, eating disorders, lifespan counseling, and end of life issues will be discussed.

NUTR 850: Leadership Concepts and Application for the Nutrition Professional

3 Credits/Maximum of 999

Exploration and application of concepts essential to effective leadership within the nutrition profession. This course will revisit and expand on the skills necessary for effective leadership within the field of nutrition introduced in NUTR 801. Theories and concepts of leadership as they apply to the nutrition field will be examined. Students will have opportunities to interview leaders in their area of interest, and they will identify the topic of their Capstone Project, which is designed to promote individual leadership development. Promotion of leadership development specific to the field of nutrition will be emphasized in the selection of a project as well as in course content. Student projects will need to be of sufficient breadth and scope to promote the utilization of skills and concepts presented throughout the M.P.S. program and this particular course. Course topics will focus on the process of identifying and creating change within an organization. The ultimate goal of the course is to foster the development of a leadership mindset for innovation, empowerment, and risk-taking.

Prerequisite: NUTR 801**NUTR 860: Capstone Project in Nutritional Sciences**

2-5 Credits/Maximum of 5

Completion of a Capstone Project involving research and application of leadership principles in nutrition practice. This course is the culminating course for the M.P.S. in Nutritional Sciences program. This course requires students to synthesize the research gathered from the leadership opportunity project, their literature review, and their Capstone Project results to prepare a paper and give a presentation of their findings to their fellow students and to a professional audience. Students will use the findings from their Capstone Project to formulate evidenced-based solutions that can be used in nutrition practice.

Prerequisite: NUTR 540 NUTR 850**NUTR 895A: Internship-Clinical**

1-18 Credits/Maximum of 18

Supervised, professional oriented, off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

NUTR 895B: Internship-Food Systems and Organization Management

1-18 Credits/Maximum of 18

Supervised, professionally oriented, off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique or activity required.

NUTR 895C: Internship-Community

1-18 Credits/Maximum of 18

Supervised, professionally oriented, off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

Operations Research (OR)

OR 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

Pathology - MD (PATH)

PATH 590: Colloquium

1 Credits/Maximum of 1

Continuing seminars which consist of a series of individual lectures by faculty, students or outside speakers.

PATH 801: Veterinary Infectious Disease Diagnostic and Surveillance Systems

3 Credits

This course provides knowledge of diagnostic and surveillance systems used to detect infectious diseases and protect against animal agricultural biological attack.

Prerequisite: AGBIO 520
Cross-listed with: AGBIO 801

Petroleum and Natural Gas Engineering (PNG)

PNG 501: Flow in Porous Media

3 Credits

This course provides students with fundamental skills to formulate problems of fluid flow in porous media in the context of reservoir engineering applications. Emphasis is placed on description of petrophysical properties, characterization methods, formulation of the equations that govern flow in porous media, and analytical solutions to steady-state flow problems.

PNG 502: Coupled Flow and Deformation in Porous Media

3 Credits

This course is a foundational course in the study of unsteady problems of flow, deformation, and transport in porous media. General topics of interest include continuum mechanics formulation of porous media, along with related mathematical solution development techniques including Green's functions, integral transforms, convolution integrals, and asymptotic expansion methods. The course further provides an overview of advanced modeling tools such as dual-continuum method and porochemoelasticity.

Prerequisite: P N G501

PNG 511: Numerical Solution of the Partial Differential Equations of Flow in Porous Media

3 Credits

Differencing schemes for the partial differential equations of single-phase flow; application to flow of gas and mixing in porous media.

PNG 512: Numerical Reservoir Simulation

3 Credits

Mathematical analysis of complex reservoir behavior and combination drives; numerical methods for the solution of behavior equations; recent developments.

PNG 518: Design of Miscible Recovery Projects

3 Credits

Theory and design of miscible methods of oil recovery, current field applications, including hydrocarbon, CO₂, micellar/polymer, alkaline, and inert gas.

PNG 520: Thermodynamics of Hydrocarbon Fluids

3 Credits

Thermodynamic science applied to hydrocarbon mixtures and problems in petroleum and natural gas engineering. General topics include study of phase diagrams of hydrocarbon fluids and application of thermodynamic rigor to phase equilibrium problems in the petroleum and natural gas industry.

PNG 526: Well Stimulation

3 Credits

Causes and identification of oil and gas wells with low productivity and or recovery; design and evaluation of well stimulation methods.

PNG 530: Natural Gas Engineering

1-3 Credits/Maximum of 3

Flow in producing or storage reservoirs; gas well testing; transmission systems; storage cycle; current developments.

Prerequisite: P N G481

PNG 555: Unconventional Resources Analysis

3 Credits

This course provides an in-depth analysis of the technical aspects of unconventional oil and gas reservoirs, such as geochemistry, geomechanics, storage mechanisms, and transport processes. The course is designed to contribute to the student's ability to advance the frontiers of knowledge about the characteristics and development of unconventional reservoirs. The course presents conceptual knowledge and mathematical models necessary for exploration, characterization, reserve estimation, and performance analysis of unconventional oil and gas reservoirs. This content is critical for the student given that conventional hydrocarbon resources are known not to be able to meet growing demand for energy to fuel worldwide economic growth, which has triggered the developments of unconventional resources such as Marcellus Shale.

PNG 566: Reservoir Characterization

3 Credits

This course focuses on the quantitative characterization of oil and gas reservoirs, principally through analysis of seismic survey data, well logs, and by employing geostatistics. Emphasis is placed on the use of seismic surveys in the oil and natural gas industries, including interpretation, inversion, rock physics, and ties to well logs. One major goal of this course is to expose the student to a variety of advanced analytical tools used to quantitatively interpret seismic data. The tools we will talk about are specifically geared towards characterizing petroleum and natural gas reservoirs, but may be adapted for other purposes.

PNG 577: Production and Completions Engineering

3 Credits

In petroleum and natural gas engineering, production and completion operations are critical components of field development operations. This course presents a high-level treatment of modern petroleum production engineering, including well deliverability from vertical and horizontal wells and diagnosis of well performance including production logging. In this course, the function of the production engineer is envisioned in the context of well design, stimulation, and artificial lift.

PNG 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars that consist of individual lectures by faculty, students or outside speakers on energy and mineral engineering issues.

Cross-listed with: EME 590

PNG 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

PNG 597: Special Topics

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

PNG 598: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

PNG 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

PNG 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

PNG 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

Pharmacology - MD (PHARM)

PHARM 520: Principles of Drug Action

2 Credits

Detailed analysis of basic parameters governing drug actions.

PHARM 551: Anti-infective Therapeutics

1 Credits

This course covers general principles related to pharmacology of major classes of antimicrobial agents. PHARM 551 Anti-infective Therapeutics (1) This course focuses on the pharmacology of anti-microbial drugs. The overall goal of the course is to examine the mechanisms of action of these drugs as well as factors determining susceptibility, resistance, selection, host factors, pharmacokinetics, and adverse reactions.

Prerequisite: BMS 501 , BMS 502 , BMS 503

PHARM 552: Integrated System Pharmacology

1 Credits

This course covers principles related to pharmacology of major classes of drugs affecting the autonomic nervous, cardiovascular, pulmonary,

and renal systems. PHARM 552 Integrated System Pharmacology (1) This course focuses on the pharmacology related to autonomic nervous, cardiovascular, pulmonary, and renal systems. The overall goal of the course is to present the mechanisms underlying the effects of drugs acting on these systems at various levels of biological organization (e.g., cell, tissue, and the whole body).

Prerequisite: BMS 501 , BMS 502 , BMS 503 , PSIO 504

PHARM 553: Gastrointestinal and Immunomodulatory Therapeutics

1 Credits

This course focuses on pharmacology of drugs affecting gastrointestinal disorders, drugs used in therapy of inflammatory diseases, and immunomodulatory drugs for organ transplantation therapy. PHARM 553 Gastrointestinal and Immunomodulatory Therapeutics (1) This course covers the use of pharmacotherapies to treat gastrointestinal disorders, inflammation, and immune response. The emphasis is to examine the mechanisms underlying the effects of these drugs at various levels of biological organization (e.g., cell, tissue, and the whole body).

Prerequisite: BMS 501 , BMS 502 , BMS 503

PHARM 554: Anticancer Therapeutics

1 Credits

This course provides an understanding of general principles of the induction, prevention and treatment of cancer. PHARM 554 Anticancer Therapeutics (1) This course introduces students to the concept of the multi-step process involved in carcinogenesis. Discussion of both synthetic drugs and naturally occurring compounds used in cancer prevention and cancer treatment is included. Potential future targets for cancer therapy are presented.

Prerequisite: BMS 501 , BMS 502 , BMS 503

PHARM 561: Neuropharmacology

2 Credits

This course introduces basic principles of human neuropharmacology, with primary emphasis on drugs active in the central nervous system. PHARM 561 Neuropharmacology (2) This course covers the use of pharmacotherapies to treat a variety of neuropsychiatric disorders and other disorders of central nervous system function. Discussion includes: 1) normal neurophysiology; 2) the neuropathology of common disorders; 3) mechanisms of action of drugs affecting the central nervous system and of drugs used to treat disorders of this system; 4) the experimental bases for our knowledge of the actions of these drugs; 5) animal models useful for drug discovery; and 6) the mechanisms underlying drugs of abuse.

Prerequisite: BMS 501 , BMS 502 , BMS 503

PHARM 562: Endocrine Pharmacology

2 Credits

This course presents basic principles of human endocrine pharmacology, emphasizing drugs active in the endocrine and reproductive systems. PHARM 562 Endocrine Pharmacology (2) This course covers pharmacotherapies used to treat disorders of the endocrine and neuroendocrine systems and to modulate reproduction. Discussion includes: 1) the physiological basis for normal endocrine homeostasis;

2) the pathology of common disorders; 3) the mechanisms of action of drugs affecting these systems and of drugs used to treat disorders of these systems; 4) the experimental bases of these drugs and therapies; and 5) animal models useful for endocrine drug discovery.

Prerequisite: BMS 501 , BMS 502 , BMS 503

PHARM 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

PHARM 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

PHARM 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

PHARM 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

PHARM 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

Philosophy (PHIL)

PHIL 501: American Philosophy Seminar

3 Credits/Maximum of 6

Critically examines central figures in American philosophy including Emerson, Thoreau, Pierce, James, Royce, Dewey, Santayana, Mead, Quine, Davidson, and Rorty.

PHIL 502: European Philosophy Seminar

3 Credits/Maximum of 6

Critically examines central European philosophers including Husserl, Heidegger, Sartre, Merleau-Ponty, Gadamer, Levinas, Foucault, and Derrida; course content varies with instructor.

PHIL 503: Ethics Seminar

3 Credits/Maximum of 6

Critical investigation of philosophical problems in ethics, and viability of historical and contemporary ethical positions; course content varies with instructor.

PHIL 508: Social and Political Philosophy Seminar

3 Credits/Maximum of 6

Critical examination of social and political philosophies, their historical context and relation to philosophic method; course content varies with instructor.

PHIL 512: Seminar in Logic

3 Credits

This course covers topics in first-order symbolic logic with identity and advanced special topics in metatheory.

PHIL 516: Aesthetic Seminar

3 Credits/Maximum of 6

Critical examination of problems in philosophy of art including beauty, taste, value, politics, culture, interpretation; course content varies with instructor.

PHIL 538: Feminist Philosophy Seminar

3 Credits

Critically examines feminist approaches to ethics, epistemology, philosophy of science, metaphysics, social/political philosophy, and the history of philosophy. PHIL (WMNST) 538 Feminist Philosophy Seminar (3) This course aims to give students an understanding of the philosophical concepts and problems of feminist philosophy. The course will focus on major topics, such as the history of philosophy, ethics, social/political philosophy, epistemology and philosophy of science, and metaphysics, and figures within 20th century feminist philosophy with the concurrent goal of brining them to bear on contemporary issues involving gender's relationship to race, sexuality, class, disability, nationality and age. This course builds upon PHIL 438 Feminist Philosophy and counts towards the requirements of the dual title degree in Philosophy and Women's Studies. Evaluation methods include preparation for and participation in class meetings, two short discussion papers, and a final term paper. The course will be offered at least once every four semesters with an enrollment goal of 20. Specific course content will vary with instructor.

Cross-listed with: WMNST 538

PHIL 539: Critical Philosophy of Race

3 Credits/Maximum of 6

The study of philosophical issues raised by racism and by the concept of race and other related concepts. PHIL 539 Critical Philosophy of Race (3 per semester/maximum of 6) This course provides an intensive examination of a major area of philosophical research: the philosophical examination of racism and of our thinking about race. It will investigate philosophical debates about such topics as mixed-race identity, going beyond the Black-White binary, the distinction between racism and xenophobia, the distinction between race and ethnicity, the debate about the reality of race, as well as questions about the nature and genealogy of racism. The course will have a historical component that will show how thinking in terms of the concept of race first developed and was transformed across time as well as addressing contemporary issues that includes an examination both of the dominant theories and definitions or racial identity and of ethical and political questions raised by the persistence of the notion of race. The course will also examine

debates about the complicity of certain canonical figures in the history of philosophy, such as Immanuel Kant and Georg Wilhelm Friedrich Hegel in the conceptualization of race and the spread of philosophical racism. In addition to these two philosophers the following authors will be among those studied: Johann Friedrich Blumenbach, Frederick Douglass, Antenor Firmin, W. E. B. Du Bois, Anna Julia Cooper, Alain Locke, Paulette Nardal, Jean-Paul Sartre, Frantz Fanon, Anthony Kwame Appiah, Gloria Anzaldúa, Bernard Boxill, and Angela Davis. Race will be examined in its relation to other ways of thinking about human difference, including class, gender, nationality, religion, and sexuality. Attention will be given to diverse experiences in the US context, such as those of African Americans, Latina/os, Asian Americans, Native Americans, Irish Americans, and so on. In addition to examining the role race has played and continues to play in the United States of America, the ways in which race is approached in other parts of the world, for example in China, will also be the subject of investigation. The course content will vary, dependent upon the instructor

PHIL 553: Ancient Philosophy Seminar

3 Credits/Maximum of 6

Analyzes specific concerns and texts of ancient philosophy including those of Plato and Aristotle; course content varies with instructor.

PHIL 554: Medieval Philosophy Seminar

3 Credits/Maximum of 6

Critical examination of medieval texts and philosophers, including Augustine, Anselm, Aquinas, Duns Scotus, and Ockham; course content varies with instructor.

PHIL 555: Modern Philosophy Seminar

3 Credits/Maximum of 6

Examines rationalism, empiricism, and other philosophical movements from Bacon and Descartes to Kant and Mill; course content varies with instructor.

PHIL 556: 19th-Century Philosophy Seminar

3 Credits/Maximum of 6

Examination of philosophy from Hegel to Nietzsche on history, dialectic, ideology, existence, science, and art; course content varies with instructor.

PHIL 557: 20th Century Philosophy Seminar

3 Credits/Maximum of 6

Central problems in works of twentieth-century philosophers including Russell, Dewey, Wittgenstein, Heidegger, Foucault, Levinas; course content varies with instructor.

PHIL 558: Contemporary Philosophy Seminar

3 Credits/Maximum of 6

Critically investigates diverse recent figures and problems of continental, pragmatic, and analytic philosophy; course content varies with instructor.

PHIL 560: Africana Philosophy

3 Credits

This course explores and analyzes existing and emerging dominant themes in Africana philosophical discourse. It examines the construction of the Africana Philosophy canon and dominant themes that emerge within that canon while also identifying new directions for this important area of philosophy. With this in mind students will explore central foundational articles and books that signaled the rise of Africana Philosophy, edited collections and anthologies in Africana Philosophy, existing course syllabi, and more recent trajectories in Africana Philosophy in the 21st Century. Furthermore, the course will make central not only the contributions of early and contemporary male philosophers and activist-intellectuals to this tradition, but also critical women philosophical figures (who have often been marginalized by their male counterparts).

PHIL 562: Major Figures in Modern Philosophy

3 Credits/Maximum of 12

Close study of a major figure in modern philosophy through one central or several important texts.

PHIL 563: Major Figures in Nineteenth-Century Philosophy

3 Credits/Maximum of 12

Close study of a major figure in nineteenth-century philosophy through one central text or several important texts. PHIL 563 Major Figures in Nineteenth-Century Philosophy (3 per semester/maximum of 12) This course provides an intensive examination of one major figure in nineteenth-century philosophy, such as Friedrich Wilhelm Schelling, Georg Friedrich Hegel, Arthur Schopenhauer, Auguste Comte, William James, Karl Marx, Charles Sanders Peirce, and Friedrich Nietzsche. Regardless of the figure selected, the course focuses on one major text written by that figure (such as in the case of Hegel the Phenomenology of Spirit or in the case of Schopenhauer The World as Will and Representation) or on two complementary texts by a major figure (for example, Schelling's First Outline of a System of the Philosophy of Nature and his The Ideas for a Philosophy of Nature or Nietzsche's Beyond Good and Evil and The Genealogy of Morals). Possible topics covered in relation to the figure selected would include as appropriate to the figure: knowledge; reason; language; subjectivity; logic; nature and spirit; dialectics; ideology; philosophy of history; religion; truth; ethics; aesthetics; and genealogy. The students will also be introduced to the major secondary works written about this author and the controversies they have generated. The course content will vary, dependent upon the instructor.

PHIL 564: Major Figures in Twentieth-Century Philosophy

3 Credits/Maximum of 12

Close study of a major figure in twentieth-century philosophy by means of one central text or several important texts. PHIL 564 Major Figures in Twentieth-Century Philosophy (3 per semester/maximum of 12) The course aims to provide students with a "building block" in their knowledge of the history of philosophy. That is, the students will achieve an expert's understanding of the central ideas of one figure in twentieth-century philosophy. On this basis, students will be able to develop a comprehensive understanding of the figure's entire corpus and complete range of ideas. Moreover, students will be able to develop a comprehensive understanding of the historical period.

There are many possible figures for this course: Edmund Husserl, Martin Heidegger, Emmanuel Levinas, Hans-Georg Gadamer, Jean-Paul Sartre, Maurice Merleau-Ponty, Simone de Beauvoir, Jacques Derrida, Gilles Deleuze, Michel Foucault, Julia Kristeva, Alain Badiou, John Dewey, Jurgen Habermas, Rudolf Carnap, Wilfred Sellars, W. V. O. Quine, Hilary Putnam, and Richard Rorty. In relation to Husserl, for example, students will master the problems (relativism and skepticism) to which phenomenology is responding; the phenomenological method (the epoche, the reductions, eidetic variation); and how the transcendental position of phenomenology at once responds to the question of knowledge and to the question of being. This knowledge will allow students to develop an understanding of the phenomenology's crucial role in the development of twentieth-century philosophy, influencing not only existentialism, structuralism, and post-structuralism, but also analytic philosophy. In relation to Merleau-Ponty, for example, students will learn how embodied perception attempts to respond to the traditional problem of mind-body dualism. This knowledge will allow students to develop an understanding not only of Merleau-Ponty's view of language but also his view of politics. From this developed understanding of Merleau-Ponty, students will be able to understand how Merleau-Ponty differs from Bergson, Merleau-Ponty's predecessor, from Sartre, Merleau-Ponty's contemporary, and from Foucault, Merleau-Ponty's inheritor. The course content will vary, dependent upon the instructor.

PHIL 571: Perspectives and Methods in Bioethics

3 Credits

This course explores a variety of theories and methods in bioethics and applies them to a selection of current topics.

PHIL 572: Perspectives in Macro-Bioethics

3 Credits

This course explores systemic and structural issues in bioethics, and the theories and methodologies required to address them.

Cross-listed with: BIOET 502

PHIL 573: Ethics and the Responsible Conduct of Biomedical Research

3 Credits

Provides an understanding of ethical issues arising in the responsible conduct of biomedical research and frameworks for critically analyzing them.

Cross-Listed

PHIL 580: Phenomenology

3 Credits/Maximum of 6

A critical study of one or more thinkers, ideas, or movements in modern phenomenology.

PHIL 589: Philosophical Translation Seminar

2 Credits

Studies philosophical works in their original (non-English) languages; course content varies with instructor.

Prerequisite: appropriate language proficiency demonstrated by satisfactory completion of departmental translation exam in given language

PHIL 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

PHIL 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

PHIL 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

PHIL 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

PHIL 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

PHIL 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Students will teach introductory logic course--i.e., Phil 1--and other introductory level courses as required by staffing.

PHIL 603: Foreign Academic Experience

1-12 Credits/Maximum of 12

Foreign study and/or research constituting progress toward the degree at a foreign university.

PHIL 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

PHIL 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

PHIL 803: Homeland Security: Social and Ethical Issues

3 Credits

This course will examine the social, political, legal, and ethical issues that arise in the context of homeland security.

Cross-listed with: HLS 803

PHIL 804: Ethics of Artificial Intelligence

3 Credits

Artificial Intelligence (AI) is the use of machines to do tasks that seem to require human intelligence and cognitive skills (thinking, natural language, inference, decision making etc.) The Ethics of Artificial Intelligence is the young branch of applied ethics that seeks to study the far-reaching and diverse ethical issues that arise with the widespread and rapid integration of AI technologies into various aspects of our lives. The challenge is that we are in an uncharted ethical territory with regard to AI: we need to radically adjust our existing ethical paradigms or introduce new ones as we experience and acquire a better grasp of the problems involved in AI-human interaction. A large portion of these issues reflect our concerns about the harm that the use and misuse of AI might cause for humanity. Such issues range from threats to individual privacy and freedom to wider social implications regarding economic justice and race and gender equality. However, as AI systems develop and attain higher levels of intelligence, questions about their moral status become more pressing. If these systems are capable of moral agency, then not only do they have responsibilities towards other moral agents like us, but they also have rights that we should respect in our conduct towards them. This course offers an overview of the nature and extent of the ethical issues arising from AI-human interaction as well as the philosophical background (particularly, in ethics and philosophy of mind) required to develop an informed methodology in approaching these issues, with the help of the flourishing literature on the subject.

Cross-listed with: A-I 804

Physics (PHYS)

PHYS 510: General Relativity I

3 Credits

Foundations of general relativity, elements of differential geometry, Einstein's equation, Newtonian limit, gravity waves, Friedmann cosmologies and Schwarzschild solution.

Prerequisite: PHYS 557

PHYS 511: Topics in General Relativity

3 Credits

Selected topics from: Cauchy problem, Hamiltonian formulation, positive energy theorems, asymptotics, gravitational radiation, singularity theorems, black-holes, cosmology, observational tests.

Prerequisite: PHYS 510

PHYS 512: Quantum Theory of Solids I

3 Credits

Electrons in periodic potentials; single electron approximations; lattice dynamics; electrical, optical, and magnetic properties of solids; transport theory.

Prerequisite: PHYS 412; Concurrent: PHYS 517

PHYS 513: Quantum Theory of Solids II

3 Credits

Electron-phonon interaction, BCS theory; Landau Fermi-liquid theory; disorder and localized states; spin-wave theory; many-body theory.

Prerequisite: PHYS 512

PHYS 514: Physics of Surfaces, Interfaces, and Thin Films

3 Credits

This course focuses on interfacial and surface phenomena; structural, electronic, vibrational and thermodynamic properties; physisorption and chemisorption; phase transitions and ultrathin film nucleation; and growth phenomena.

Prerequisite: PHYS 412

PHYS 515: Density Functional Theory and Practice

3 Credits

This course gives students an overview of the theory and practice of calculations performed with Density Functional Theory (DFT). DFT is a powerful tool to calculate the structural and electronic properties of collections of atoms. The course emphasizes the practical aspects of the calculations and the theory will be only described as necessary to understand and perform correct calculations. The target audience of the course is students of Physics, Chemistry, Materials Science, Chemical or Mechanical Engineering, and other science/engineering disciplines that need to learn to perform calculations based on DFT with a minimum of exposure to the theoretical details underlying this technique.

Cross-listed with: CHE 515

PHYS 517: Statistical Mechanics

3 Credits

Thermodynamics, classical and quantum statistics; Bose and Fermi gases; Boltzmann transport equation; phase transitions, critical phenomena; Ising model.

Prerequisite: PHYS 561

PHYS 518: Critical Phenomena and Field Theory

3 Credits

Critical phenomena using field theoretical and renormalization group techniques; solvable statistical models and conformal field theory; fluctuations and random processes. PHYS 518 Critical Phenomena and Field Theory (3) The application of field theoretical methods, in particular, the renormalization group approach, has profoundly influenced our understanding of the physics of continuous phase transitions. In particular, they reveal the origin of universality between seemingly

unrelated phase transitions, and the reason for the failure of the Landau Ginzburg theory close to the critical point. This course will begin with the concepts of the order parameter and spontaneous symmetry breaking, and the shortcomings of the Landau Ginzburg theory that neglects fluctuations of the order parameter. Subsequently, we will introduce field theoretical techniques and Feynman diagrams, and the basic foundations of the renormalization group method for integrating out rapidly fluctuating modes of the order parameter. These concepts will be applied to various classes of phase transitions, including the Heisenberg ferromagnet, nonlinear sigma model, and the Kosterlitz-Thouless model. Epsilon expansion will be performed in detail starting from both four and two dimensions, and a connection will be made to experiments, such as superfluid transition in thin helium films. No prior knowledge of field theory is required. The course grade will be based upon homework assignments and a term paper.

Prerequisite: PHYS 517

PHYS 524: Physics of Semiconductors and Devices

3 Credits

Electronic structure, optical and transport properties of crystalline and amorphous semiconductors, quantum wells, superlattices; quantum devices; quantum Hall effect.

Prerequisite: PHYS 412

PHYS 525: Methods of Theoretical Physics I

3 Credits

Complex variables, Hilbert spaces, linear operators, calculus of variations, Fourier analysis, Green's functions, distributions, differential equations, and special functions.

PHYS 526: Methods of Theoretical Physics II

3 Credits

Finite and Lie groups, representations and application to condensed matter and particle physics; selected topics from differential geometry.

Prerequisite: PHYS 525

PHYS 527: Computational Physics and Astrophysics

3 Credits

This course provides an advanced overview of applications of numerical methods and computer programming to physics and astrophysics. Numerical calculations provide a powerful tool for understanding physical phenomena, complementing laboratory experiment and analytical mathematics. The main objectives of the course are: to survey the computational methods used for modeling physical and astrophysical systems; to apply the computational methods to solve real world problems in physics and astrophysics; to assess the reliability of numerical results using convergence tests and error estimates; and to use scientific visualization as a tool for computer programming development and for physical understanding of numerical results. Strong programming skill in any of the common programming languages such as C, C++, or Python, is highly recommended.

Recommended Preparations: Strong programming skills are highly recommended.

Cross-listed with: ASTRO 527

PHYS 529: Neural Control Engineering

3 Credits

The ability to use formal control theory to observe and control neuronal systems is rapidly becoming more feasible as our models of neural systems become more realistic and as our advances in nonlinear Kalman filtering become more sophisticated. This course will explore the cutting edge of nonlinear state estimation of neuronal systems and the construction of control algorithms based on that state estimation. We will give an overview of several canonical neuroscience models, which represent experimental systems that can be controlled: the Hodgkin-Huxley equations, their reduction with the Fitzhugh-Nagumo equations, the Wilson-Cowan model of cortex, and recent models of Parkinson's disease. We will then apply nonlinear state estimation to measurements from such systems and construct control algorithms that interact with such models.

RECOMMENDED PREPARATIONS: Students without a background including calculus, differential equations, and linear algebra should consult with the instructor.

Cross-listed with: ESC 529

PHYS 530: Theoretical Mechanics

3 Credits

Newtonian mechanics, noninertial coordinate system, Lagrangian mechanics, small oscillations, Hamiltonian formulation, canonical transformations, Hamilton-Jacobi theory, dynamical systems.

Prerequisite: PHYS 419

PHYS 541: Elementary Particle Phenomenology

3 Credits

Baryons and mesons; leptons and quarks; electromagnetic and weak interactions and their unification; quantum chromodynamics; experimental techniques.

Prerequisite: PHYS 562

PHYS 542: Standard Model of Elementary Particles Physics

3 Credits

Weinberg-Salam model of electroweak interactions, spontaneous symmetry breaking, quantum chromodynamics; selected topics from grand unified theories and superstring theory.

Prerequisite: PHYS 564

PHYS 545: Cosmology

3 Credits

Modern cosmology of the early universe, including inflation, the cosmic microwave background, nucleosynthesis, dark matter and energy. ASTRO (PHYS) 545 Cosmology (3) Cosmology is the scientific study of the universe as a whole: its physical contents, principal physical processes, and evolution through time. Modern cosmology, which began in the early 20th century, is undergoing a renaissance as a precision science as powerful ground- and space-based telescopes allow us to observe the formation of the first stars, galaxies and galaxy clusters; the

echoes of the inflationary epoch as they are impressed upon the cosmic microwave background; and evidence for and clues to the nature of the mysterious dark energy, which is driving the accelerating expansion of the universe. This course will introduce students to the key observations and the theoretical framework through which we understand the physical cosmology of the early universe.

Cross-listed with: ASTRO 545

PHYS 555: Polymer Physics I

3 Credits

Introduction to the fundamental concepts needed to understand the physics applicable to polymer melts, solutions and gels. MATSE (PHYS) 555 Polymer Physics I (3) This course develops fundamental understanding of the conformations of polymers in solution and melt states. We start with ideal chains that have random walk statistics. Next excluded volume is introduced to understand the self-avoiding walk conformation and collapsed conformation of real chains. The behavior ideal and real chains are studied in extension, compression and adsorption. While positive excluded volume leads to swelling, negative excluded volume leads to collapse and phase separation. The phase behavior of polymer mixtures and solutions is described in detail. Semidilute solutions are understood in terms of two length scales where each chain changes its conformational statistics. Scattering is used to determine the conformation of chains, their molar mass and their interactions with surroundings. Percolation theory is introduced to model the statistics of random branching and gelation. The rubber elasticity of fully developed networks is understood in terms of the stretching laws for network chains. Entanglement effects, swelling and viscoelasticity are discussed in detail. Once the conformations of polymers are understood, dynamics of polymer liquids are considered. In dilute solutions hydrodynamic interactions dominate and the viscoelasticity predicted by the Zimm model is derived. In unentangled melts of short chains, hydrodynamic interactions are screened and the Rouse model is used to understand viscoelasticity. Unentangled polymers in semidilute solutions have Zimm dynamics on small length scales and Rouse dynamics on longer length scales. Dynamic scattering techniques are discussed for measuring polymer dynamics. Entanglement effects are described using the tube model, where surrounding chains confine the motion of a given polymer to a tube-like region. The effects of concentration, chain length and polydispersity of linear chain polymer liquids are discussed in detail. The effects of branching on polymer dynamics are introduced at the level of simple structures such as star polymers and comb polymers. The course assumes some prior knowledge of polymers, usually obtained through an introductory undergraduate course. The students should attain a working understanding of the basic concepts of polymer physics in this course, allowing them to tackle more difficult problems in their research. Such skills are reinforced through homework and take-home examinations.

Cross-listed with: MATSE 555

PHYS 557: Electrodynamics

3 Credits

Special relativity, electromagnetic fields, Maxwell's equations, conservation laws, electrostatics and magnetostatics. PHYS 557 Electrodynamics (3) The first half of the course starts from special relativity and uses Hamilton's principle to derive relativistic dynamics and Maxwell's equations. This approach, developed by Landau and Lifshitz, sets classical electrodynamics in a broad base of theoretical physics, and

provides insights to solving many interesting problems that might be hard to solve starting from the traditional approach of deriving Maxwell's equations empirically through Coulomb's law, the law of Biot and Savart, Faraday's law, and Maxwell's inclusion of displacement current. The second half is based on the classic textbook by Jackson, and is devoted to application of electrodynamics in various settings. This includes dynamics of charged particles in given electromagnetic fields, with special emphasis on problems with symmetry and the guiding center dynamics. Examples of such topics include electromechanical problems with the use of Lagrangian; fields generated by given distributions of charges and currents, especially for case of small sources, and the use of multiple expansions; polarization and magnetization, and Maxwell's equations in continuous media; boundary value problems; electromagnetic waves with single frequency in vacuum and medium; wave guides and resonant cavities; the generation of electromagnetic radiation.

Prerequisite: PHYS 400

PHYS 559: Graduate Laboratory

2 Credits

Study and applications of techniques and instrumentation used in modern physics laboratories.

PHYS 561: Quantum Mechanics I

3 Credits

Postulates of quantum mechanics, Hilbert space methods, one dimensional potentials, spin systems, Harmonic oscillator, angular momentum, Hydrogen atom.

Prerequisite: PHYS 410

PHYS 562: Quantum Mechanics II

3 Credits

Addition of angular momenta, perturbation theory, variational principle, scattering theory, density matrices, identical particles, interpretations of quantum mechanics, Dirac theory.

Prerequisite: PHYS 561

PHYS 563: Quantum Field Theory I

3 Credits

Canonical and functional integral quantization of relativistic and non-relativistic field theories; Feynman diagrams; spontaneous symmetry breaking; renormalization group.

Prerequisite: PHYS 562

PHYS 564: Quantum Field Theory II

3 Credits

Abelian and non-Abelian gauge theories; renormalization group and operator product expansions; BRST quantization; scattering theory, other related topics.

Prerequisite: PHYS 563

PHYS 565: Interface of General Relativity and Quantum Physics

3 Credits

Limitations of perturbative methods, conceptual problems; selected topics from black hole thermodynamics, canonical quantum gravity, loop space methods and string-theory.

Prerequisite: PHYS 510 , PHYS 563

PHYS 570: Particle Astrophysics

3 Credits

Particle astrophysics is a discipline at the interface between physics and astronomy, which has undergone tremendous growth in the 21st century, with the commissioning and exciting results from very large facilities detecting the highest energy cosmic rays, neutrinos, gravitational waves, and gamma-rays. There is a rapid and ongoing expansion of the understanding of these radiations, their physics and their sources, which include supernovae, gamma-ray bursts, and active galactic nuclei, and there are major new facilities aimed at characterizing particle properties of dark matter and its cosmological effects. Students will be given an overview of the basics of particle astrophysics and to the latest data and its interpretation, stressing issues currently discussed by the community, with particular attention on major projects in which Penn State faculty are involved. The course is designed for graduate students in physics and astronomy and astrophysics, being also appropriate for students in nuclear engineering or related disciplines.

Prerequisites: ASTRO 502; PHYS 400; PHYS 406 PHYS 557

Cross-listed with: ASTRO 570

PHYS 571: Modern Atomic Physics

3 Credits

Light-atom interactions, atomic structure, laser cooling and trapping, interferometry, and Bose-Einstein condensation. PHYS 571 Modern Atomic Physics (3) Students will learn the physics behind most of the major recent developments in the field of atomic physics, at the level required for research at the graduate level. Material to be covered will include selected topics from the following list: Light-atom interactions, atomic structure, laser cooling, atom trapping and atomic optics, atom interferometry, precision measurements with atoms, quantum computing with atoms, atomic Bose-Einstein condensates, degenerate Fermi gases, reduced dimensionality systems, simulating condensed matter physics with atoms. Students will enhance their technical writing and presentation skills. Students will use the background they have acquired to develop an oral presentation related on a research advance related to modern atomic physics.

Prerequisite: PHYS 411 , PHYS 561 , or CHEM 565

PHYS 572: Laser Physics and Quantum Optics

3 Credits

Theory of modern lasers, non-linear and quantum optics, photon statistics, laser spectroscopies, pulsed lasers. PHYS 572 Laser Physics and Quantum Optics (3) Students will learn the basic physics of lasers, how they work and how they are used, primarily for physics research at the graduate level. They will become familiar with a broad array of the most important topics of laser physics including mode competition, pulsed lasers, pulse propagation, non-linear laser spectroscopy, laser stabilization, and the quantum nature of laser light. Students will enhance

their technical writing and presentation skills. Students will use the background they have acquired to develop an oral presentation related on a research advance related to lasers.

Prerequisite: PHYS 410 , PHYS 561 , or CHEM 565

PHYS 580: Elements of Network Science and Its Applications

3 Credits

Introduction to elements of network theory used to describe and model complex networks; applications in social, biological, and technological networks. PHYS 580 Elements of Network Science and Its Applications (3) Network Science is the study of network representations of physical, biological, and social phenomena leading to predictive models of these phenomena. This class will focus on four main questions asked by network science: (i) How do we use data analysis methods to determine or infer the interaction graphs underlying complex systems? (ii) How can we characterize the organizational features of large-scale networks? (iii) What are the mechanisms that determine the common topological features of a wide variety of networks? (iv) To what extent does the organization of the interaction network underlying a complex system determine the dynamical behavior (e.g. steady state or oscillations) of the system? Applications in social, biological and technological networks will be examined. As Network Science is an interdisciplinary field of research, the course is open and should be of interest to a wide range of graduate students in degree programs in physics, social sciences, life sciences, mathematics, engineering, and computer science.

Prerequisite: knowledge of basis calculus

PHYS 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

PHYS 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

PHYS 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

PHYS 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

PHYS 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

PHYS 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Supervised experience in teaching and orientation to other selected aspects of the profession at The Pennsylvania State University

PHYS 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

PHYS 801: Foundations of Teaching in Physics

1 Credits

An overview of the science of teaching and learning physics. This course will prepare physics graduate students to become both better learners and teachers through reading about, discussing, observing and practicing inclusive, evidence-based instructional and learning strategies.

Physiology (PHSIO)

PHSIO 510: Physiological Adaptations to Stress

3 Credits

Students will learn how to address problems in physiological adaptations to stress through parallel molecular, cellular, and systemic approaches.

Prerequisite: PHSIO571 , PHSIO572

PHSIO 567: Advanced Exercise Physiology

3 Credits

Physiological changes during exercise with emphasis on the effects of physical conditioning and training.

Prerequisite: BIOL 472 , EXSCI480

Cross-listed with: KINES 567

PHSIO 571: Integrative and Cellular Mammalian Physiology I

3 Credits

Mammalian cardiovascular, respiratory, renal, and gastrointestinal systems. This course in Cellular and Integrative Mammalian Physiology covers all major aspects of physiology. A special emphasis will be placed on how cellular aspects of physiology are integrated with organ and systems physiology. It is designed for students that either major in Physiology or are interested in integrating physiology concepts into their education. An in depth presentation of membrane biophysics, muscle dynamics, cardiovascular and circulatory regulation, respiratory and renal function, as well as acid base balance are addressed.

Prerequisite: BIOL 472

Cross-listed with: BIOL 571

PHSIO 572: Integrative and Cellular Mammalian Physiology II Endocrine Physiology

3 Credits

The course in Cellular and Integrative Mammalian Physiology II covers all major aspects of endocrine physiology. A special emphasis will be placed on how cellular aspects of physiology are integrated with organ

and systems physiology. This course is designed for graduate students in the Physiology or Animal Science graduate programs, or students who are interested in integrating physiology concepts into their work in another program. Although there are no prerequisites for the course, prior courses in physiology, endocrinology, and/or biochemistry are beneficial. The course will include the following topics: gastrointestinal physiology, pancreatic hormones and integrated metabolism, hypothalamic pituitary function, thyroid, parathyroid and bone, as well as physiology of growth and lactation. Additional topics will encompass adrenal function, sexual differentiation, male and female reproduction, embryo and adult derived stem cells, aging, obesity, and metabolic syndrome.

PHSIO 577: Cardiovascular Physiology

3 Credits

In-depth study of the heart and circulatory system with emphasis on the effects of exercise on cardiovascular function.

Prerequisite: KINES484

Cross-listed with: KINES 577

PHSIO 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students or outside speakers.

PHSIO 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

PHSIO 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

PHSIO 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

PHSIO 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

Physiology - MD (PSIO)

PSIO 501: Scientific Analysis and Presentation

1 Credits

Journal club format used to develop critical analytical and presentation skills for understanding and clearly presenting current scientific data.

PSIO 504: Cellular and Integrative Physiology

3 Credits

PSIO 504 is a physiology course that integrates cellular and organ-based physiology concepts. PSIO 504 Cellular and Integrative Physiology (3) The course in Cellular and Integrative Physiology is a one semester, three credit course that will cover all major aspects of physiology. A special emphasis will be placed on how cellular aspects of physiology are integrated with organ physiology. The course will meet for 1 hour sessions, three times per week. The course will be offered in the fall semester. It is designed for graduate students that either major in Physiology or are interested in integrating physiology concepts into their graduate education. Although there are no prerequisites for the course prior introductory courses in physiology and/or biochemistry are beneficial. The course will expand upon material in an assigned physiology textbook. Text chapters will be assigned as reading material prior to each meeting. The instructor will review the assigned material during the beginning of each meeting, after which more detailed aspects of the material will be discussed. The course will have three examinations. The exams will be composed of a mixture of short essays, multiple choice and problem-solving questions. The lectures in PSIO 503 form the first block of the lectures in the more comprehensive PSIO 504 course. Students should enroll in either PSIO 503 or PSIO 504.

PSIO 505: Cellular and Integrative Physiology II

3 Credits

This is a physiology course that integrates cellular and organ-based physiology concepts. PSIO 505 Cellular Integrative Physiology II (3) The course, is a one-semester, 3-credit-course that will cover major aspects of physiology not covered in Cellular and Integrative Physiology I. A special emphasis will be placed on how cell function and differentiation are integrated with organ physiology. The course will meet for one-hour sessions, three times per week. The course will be offered in the spring semester. It is designed for graduate students that either major in Physiology or are interested in integrating physiology concepts into their graduate education. PSIO 504 (Cellular and Integrative Physiology I) is a prerequisite for the course. Prior introductory courses in physiology and/or biochemistry are beneficial. The course will expand upon material in an assigned physiology textbook. Text chapters will be assigned as reading material prior to each meeting. The instructor will review the assigned material during the beginning of each meeting, after which more detailed aspects of the material will be discussed. The course will have two examinations. The exams will be composed of a mixture of short essays, and multiple-choice and problem-solving questions.

Prerequisite: PSIO 504

PSIO 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students or outside speakers.

PSIO 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects including nonthesis research, supervised on an individual basis and which fall outside the scope of formal courses.

PSIO 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

PSIO 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

PSIO 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

PSIO 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

PSIO 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

Plant Biology (PLBIO)

PLBIO 512: Plant Resource Acquisition and Utilization

4 Credits

Advanced study of plant resource acquisition and utilization considering molecular, physiological, and whole plant perspectives through lectures and problem solving.

PLBIO 513: Integrative Plant Communication and Growth

4 Credits

Advanced study of plant communication, growth, and development considering molecular, physiological, and whole plant perspectives through lectures and problem solving.

PLBIO 514: Modern Techniques and Concepts in Plant Ecophysiology

2 Credits

An intensive overview to concepts of plant ecophysiology and modern techniques used in this field.

Prerequisite: BIOL 220W

PLBIO 515: Modern Techniques and Concepts in Plant Cell Biology

2 Credits

An intensive introduction to concepts of plant cell biology and modern techniques used in this field.

Prerequisite: introductory course in plant physiology

PLBIO 516: Modern Techniques and Concepts in Plant Molecular Biology

2 Credits

An intensive introduction to contemporary molecular biology methods as applied to the study of plants.

Prerequisite: general biology and plant physiology at the undergraduate level

PLBIO 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

PLBIO 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

PLBIO 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

PLBIO 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

PLBIO 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

PLBIO 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

Plant Pathology (PPATH)

PPATH 502: Plant Disease Diagnosis

3 Credits

Field and laboratory techniques used in diagnosing plant diseases caused by various types of pathogens with emphasis on fungi.

Prerequisite: PPATH401

PPATH 505: Fundamentals of Phytopathology

4 Credits

An in-depth tutorial of the fundamental theories and concepts of plant pathology. PPATH 505 Fundamentals of Phytopathology (2) Using the primary literature of the discipline, students will explore, in-depth, the knowledge base of plant pathology. Students will write a 3-5 page paper each week summarizing the major points of the topic covered in the primary literature assigned as related to 4 pathogens/diseases chosen by

each student from an approved list. Students will also answer, in writing, 1-2 specific questions posed by the instructor each week. These writings constitute 90% of the grade. 5% of the grade is based upon a written final exam and 5% on oral participation in class.

Prerequisite: PPEM 405

PPATH 522: Professional Development & Ethics in Plant Pathology

1 Credits

Graduate students will develop key professional skills and ethics through a combination of lectures, discussions, and assignments. PPATH 522 Professional Development & Ethics in Plant Pathology (1) This course is designed to help graduate students acquire key professional skill and ethics through a combination of lectures, case study discussions on various ethics and professionalism issues, dialogs with invited guests about their professional experience, and mock exercises of paper and proposal reviews. Topics to be covered include: (a) the process and ethics of publishing, (b) how peer review of papers and grant proposals works, (c) plagiarism, (d) scientific misconduct, (c) oral and poster presentation skill, and (f) successful strategies in grant proposal writing and proposal review.

PPATH 533: Molecular Genetics of Plant-Pathogen Interactions

3 Credits

In depth discussion/review of the primary literature on the mechanisms of plant-pathogen interactions at the molecular and cellular levels. PPATH 533 Molecular Genetics of Plant-Pathogen Interactions (3) The main objective of this 3-credit course is to help students gain (a) firsthand knowledge of various techniques used in studying the molecular basis of plant-pathogen interactions and (b) knowledge of the current concepts and theories on the nature and mechanisms of the plant-pathogen interactions. In addition, this course will help students develop an ability to integrate and synthesize various areas of knowledge in solving plant health related problems. This course will serve the needs of students in Plant Pathology and other departments/programs who require an in-depth understanding of the molecular basis of plant-pathogen interactions for their program of study. This course will be offered in fall of even numbered years, and its expected enrollment is 8-10. Grading will be based on class participation, paper presentations, assignments, and a mid-term exam.

Prerequisite: B M B400 or equivalent

PPATH 542: Epidemiology of Plant Diseases

3 Credits

Disease development in populations of plants, with emphasis on the impact of environment and control practices on rate of development.

Prerequisite: PPATH401 ; MATH 111 or MATH 141 or 3 credits in statistics

PPATH 544: Fungal Genetics

4 Credits

Fungal breeding systems, mating types, asexual restrictions and recombination, tetrad analysis, gene conversion and extra genetic elements. PPATH 544 Fungal Genetics (4) Fungal genetics will focus on the classical genetics of fungi starting with the expected inheritance ratios and patterns for single gene and multiple genes on various fungal

traits. The methods of establishing crosses and obtaining progeny will be covered in the examples provided. Mating type and breeding systems are an important trait for obtaining the sexual phase, therefore an emphasis will be placed on the genetic determination of breeding methods and mating type, and what is known of mating type switching. There are several unique phenotypes associated only with fungi (pokey, senescent fungi, killer character and others) inherited by mitochondrial DNA and induced by plasmids or transposons. The determination of inheritance and the importance will be examined. Fungi provide the unique opportunity to conduct tetrad analysis in determination of inheritance and mapping of traits. In the laboratory, crosses will be set up by students to obtain data to conduct tetrad analysis and to visualize unusual tetrads brought about by gene conversion. Exchange of genetic material occurs without the sexual cycle though heterokaryosis and the parasexual cycle but may be limited by vegetative incompatibility. These difficult concepts will be discussed as well as visualized by conducting experiments in the laboratory. In discussions, an emphasis will be placed on plant pathogenic fungi and inheritance of virulence which is an important plant pathogen trait. Finally topics on population genetics of fungi including determination of genetic diversity, allele frequencies, genotype frequencies will be studied. Evaluation of student performance will be based on problems sets provided throughout the semester, laboratory reports, student projects and presentations, and a final examination. The problem sets are designed to help students solve genetic problems based on the concepts learned in lecture. The laboratory experiments are designed to complement the lectures and allow students to visualize difficult concepts from lecture. Students will be assigned a plant pathogenic fungus and will explore the literature especially any relevant genetic information on that fungus. The final examination will focus on short answer questions requiring the student to synthesize information. The course will be offered every other spring semester even years. Expected enrollment is 10 students.

Prerequisite: 3 credits of mycology and introductory genetics

PPATH 555: Effective Scientific Communications

3 Credits

Students will learn to effectively present their research to scientific and non-scientific audiences. The overall goal of the course is to develop student skills in spoken and written communication of scientific concepts, methods, and data, and to provide effective evidence-based recommendations for practical application of such knowledge. In addition, students will develop skills in writing testable hypotheses, evaluating experimental approaches, considering alternative approaches, and envisioning expected outcomes of a research plan.

Cross-listed with: AEPS 555

PPATH 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

PPATH 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

PPATH 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

PPATH 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

PPATH 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

PPATH 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Supervised preparation and presentation of materials in lectures and laboratories, preparation and supervision of exams and student consultation and evaluation.

PPATH 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

PPATH 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

PPATH 802: Plant Protection: Responding to Introductions of Threatening Pests and Pathogens

3 Credits

This course provides knowledge of plant biosecurity, plant disease, regulations, and technologies using case study examples.

Cross-listed with: AGBIO 802

PPATH 840: Major Writing Projects: Start to Finish

3 Credits

In this course, students will work through a major STEM writing project (e.g. thesis proposal, review article), with the goal of having a completed project at the end of the course. Individual student goals will be agreed upon at the outset of the course by the student, the major adviser to the student, and the course instructor. Students in the course will follow a rigorous writing schedule that requires writing submissions and peer reviews most weeks. In addition to submitting and reviewing writing, students will learn a variety of relevant writing skills through both lectures and practical activities.

PPATH 853: Interpreting Turfgrass Science Literature

3 Credits

Introduction to turfgrass research publications, interpretation of the data, and discussion of the significance of the results. PPATH (TURF) 853 Interpreting Turfgrass Science Literature (3) This course will provide an introduction to literature search in turfgrass management, identification of most pertinent peer-reviewed journals for each area of interest/specialty in turfgrass management, and utilization of other resources such as technical journals, trade journals, online and resident educational material resources, extension bulletins/circulars from various institutions/organizations that addresses various topics on turfgrass management. This course will prepare the students for analyzing research questions or rationale formulated by an investigator, for understanding how the study was devised to address the objectives adequately and the results were obtained and presented in the publication, and for identifying the take-home message in the publication. Emphasis will be made on the criteria used for data collection, the significance of methods employed in statistical analyses of the data, and presentation of results in the publications to effectively convey the information to readers.

Cross-listed with: TURF 853

Political Science (PLSC)**PLSC 501: Methods of Political Analysis**

3 Credits

Survey of important methods and approaches to the study of politics; introduction to research design.

PLSC 502: Statistical Methods for Political Research

3 Credits

Basic concepts of statistics and their use in political research; data analysis, casual inference, regression analysis, computer applications.

PLSC 503: Multivariate Analysis for Political Research

3 Credits

Analysis of selected issues in quantitative political analysis; introduction to advanced multivariate analysis techniques. PL SC 503 Multivariate Analysis for Political Research (3) This course is part of the methods sequence required of doctoral students in political science. The prerequisites are PL SC 501 and PL SC 502. The course has three objectives. First, students will acquire a theoretical/mathematical understanding of multivariate regression analysis. Such understanding is fundamental to applying appropriate applications of quantitative methodology to substantive problems. Students must acquire clear and correct conceptual understanding of the statistical ideas behind the mathematics in order to succeed in this course. Second, students will learn to program in SAS to relate statistical ideas to practice and develop a set of programming skills that will benefit their research over the long run. They are expected to acquire proficiency in SAS in terms of data management and statistical analysis, which will be useful when they find the need to pick up some other statistical software package in the future. Third, students will gain experience in quantitative research by applying their statistical and computing skills to substantive problems in political science. Students should aim at producing publishable quality

work. They would also develop the ability to evaluate other scholars' use of quantitative methods.

Prerequisite: PL SC501 , PL SC502**PLSC 504: Topics in Political Methodology**

3 Credits

This course examines a range of statistical models widely used in political science that generalize from linear normal regression. PL SC 504 Topics in Political Methodology (3) This is an elective course in statistical methods designed to meet the particular needs of students in the political science Ph. D. curriculum. PL SC 504 is tailored to focus on the specific issues that arise in the types of data found in political science applications. Students are expected to have completed the three required foundational courses in political methodology or their equivalents. This course examines a range of regression-like models widely used in empirical political science. Its core focus is on maximum likelihood estimation of models for various kinds of limited-dependent and qualitative response variables. Specific models covered are widely used in political science today, including binary logit and probit, multinomial logit and probit, ordered logit and probit, and Poisson regression models. Additional topics include models for time-to-event (survival) data, panel data and time-series cross-sectional analysis, item response theory, multi-level models, and methods for causal inference using observational data. Students will apply these models in a series of homework assignments, a replication project, and a final exam. Empirical political scientists must have familiarity with these models; these techniques represent a minimal level of statistical competence necessary for those seeking to do advanced quantitative analysis in the political science. The material in this course is technical, but students will be given an intuitive rationale for each model. Weekly homework assignments will be based on data from published research in political science.

Prerequisite: PL SC503 or STAT 462 or STAT 501 or STAT 504 or STAT 511**PLSC 505: Time Series Analysis in Political Science**

3 Credits

This course provides students with a foundation in time series methods and to the applications of these methods in political science. PL SC 505 Time Series Analysis in Political Science (3) This course provides students with a foundation in time series methods and to the applications of these methods in political science. The initial focus of the course is descriptive analysis of time series, with attention given to developing an understanding of social processes that are inherently dynamic in nature and to how time series are measured. The focus then shifts to more rigorous univariate time series analysis with the introduction of linear difference equations as the foundation for understanding political dynamics, and the development of models for both stationary and nonstationary time series. The remainder of the course is devoted to an examination of traditional econometric analyses of time series using regression techniques, and an array of important topics in time series analysis including Granger causality, vector autoregression, and cointegration techniques. Students will learn the statistical theory underlying the methods of time series analysis, as well as how to apply and interpret those methods in practice.

Prerequisite: PL SC503

PLSC 506: Game Theory for Political Science I

3 Credits

This course offers foundational information regarding the use of non-cooperative game theory in political science. PL SC 506 Game Theory for Political Science I (3) This course offers foundational information regarding the use of non-cooperative game theory in political science. Game theory is a mathematical tool used to study strategic interaction in a variety of academic disciplines. Within political science, researchers who study American politics, comparative politics, and international relations use game theory to examine a broad range of political phenomena, including the outcomes of elections, the formation of governments, and the onset and duration of interstate conflict. The course introduces students to the basic concepts and principles of non-cooperative game theory, and demonstrates through examples how it can be used in the study of politics. Attention is given to both strategic (simultaneous move) and extensive form games. Topics to be covered include the concept of Nash equilibrium; mixed strategies; backward induction; subgame perfect equilibrium; incomplete information; and signaling games. The course provides students with the concepts, language, and notation needed to begin using game theory in their own research and to evaluate its application by others.

Prerequisite: PL SC500 and PL SC502

PLSC 507: Game Theory for Political Science II

3 Credits

This course offers information regarding the advanced application of non-cooperative game theory in political science.

Prerequisite: PL SC506

PLSC 508: Political Networks

3 Credits

A network is a set of relationships among units. The study of networks in political science, the social sciences, and beyond has grown rapidly in recent years. This course is a comprehensive overview of methods for analyzing network data. We will cover network data collection and management, the formulation and expression of network theory, network visualization and description, and methods for the statistical analysis of networks. The course will make extensive use of real-world applications and students will gain a thorough background in the use of network analytic software. Most of the applications discussed will be drawn from political science and sociology, but this course will be relevant to anyone interested in the study of network data.

Recommended Preparations: Students taking this course should have knowledge of hypothesis testing and regression, and experience with at least one statistical or scientific programming language (e.g., R, Stata, SAS, Python, Matlab).

PLSC 511: Professional Norms in Political Science

1.5 Credits

An introduction to professional norms, the fundamentals of good research, and the basic skills necessary for good teaching. PL SC 511 Professional Norms in Political Science (1.5) This course is the first of two courses in a required series on professional development in the graduate program in political science. The first course focuses specifically on fundamental knowledge and skills that will help graduate

students throughout graduate school but also in their later careers as a scholar. The topics over the course of the semester fall into three main themes: 1) understanding the norms and requirements of the profession; 2) the fundamentals of good research; and 3) an introduction to teaching. Professionalization topics include planning your graduate school years, putting together a curriculum vita, communicating with senior scholars, and writing the MA; teaching topics including planning a course and recitation sections, preparing lectures or discussion classes, as well as documenting your teaching; and the research fundamentals that we will discuss include defining problems, crafting arguments, outlining and revising manuscripts.

PLSC 513: Writing and Professional Development in Political Science

1.5 Credits

Professional development focusing on publishing research, writing dissertations, and professional issues of advanced graduate students. PL SC 513 Writing and Professional Development in Political Science (1.5) This course is designed to help advanced graduate students surmount the challenges they face as they turn to writing a dissertation and prepare to become junior faculty. The course is designed to give practical advice on many of the issues faced by these students. Primary among these is learning to turn initial papers into research publishable in high quality peer reviewed journals. The course also focuses on practical advice on finishing comprehensive exams, starting a dissertation and early preparation for the job market.

Prerequisite: 3rd year standing in Political Science Ph.D. program

PLSC 518: Survey Methods I: Survey Design

3 Credits

Research design of social, behavioral and health surveys. PL SC (SOC) 518 Survey Methods I: Survey Design (3) This course is intended to provide graduate students the background to both evaluate published research using survey methods, and – when combined with additional training – to design their own surveys to collect data for their own research. Students will learn the essentials of sampling, questionnaire design, and how surveys may be implemented in different modes: telephone, face to face interviews, mail or other self-administered modes, and the internet. The course will emphasize how decisions of research design have important implications for the validity, reliability, and quantity of data that will be analyzed to answer key questions in the social, behavioral and health sciences. Sample design: 2 weeks; Questionnaire design and item analysis: 2 weeks; Telephone Surveys: 2 weeks; Face to face surveys: 2 weeks; Self administered and mail surveys: 2 weeks; Internet Surveys: 2 weeks; Ethics and human subjects protection: 1 week.

Cross-listed with: SOC 518

PLSC 519: Survey Methods II: Analysis of Survey Data

3 Credits

Intermediate course on the statistical analysis of survey data: topics include weighting, complex surveys, missing data, and contextual analysis. PL SC (SOC) 519 Survey Methods II: Analysis of Survey Data (3) This is an intermediate level course in quantitative analysis. It is intended for graduate students who have completed 1-2 semesters of graduate-level statistics (not general research methods) and who are interested in the application of social statistics to the unique aspects of data collected by way of surveys. Surveys have a combination of qualities that represent challenges to valid inference. These include

cluster and stratified sampling, under-representation of some groups due to differential response rates, missing data due to item non-response, cross-sectional design, and coarse measurement. Quite often we use surveys to test theories that the original survey designer did not intend to address, raising issues of validity and reliability of measurement. At the same time, surveys offer a number of opportunities and, when combined with other surveys (pooled cross sections) or merged with contextual data, can address a wide range of theoretical puzzles in the social sciences. This course provides an introduction to techniques in applied statistics that have developed specifically to address the special features of survey data. Examples of such techniques are: use of design weights, post-stratification weights, merging surveys with other surveys or auxiliary data, missing data imputation, challenges of causal inference. The class will blend an understanding of the core statistical issues with an emphasis on acquiring an intuition for the theory underlying the statistical models rather than focusing on proofs and estimation. This will provide a foundation for frequent hands-on applications in this seminar and for enrollment in more advanced or more in-depth courses offered by the Statistics department and the various social science departments.

Prerequisite: PL SC503 or SOC 575

Cross-listed with: SOC 519

PLSC 534: Political Economy of Energy and Extractive Industries in Africa (Oil and Mining)

3 Credits

Given the rising global demand for energy and resources, Africa's production of oil and solid minerals has already produced very significant positive as well as negative impacts on the continent's political, economic, and social conditions. This seminar examines the extractive industry-driven changes in Africa's political economy, as well as in the continent's foreign relations. Students will examine the institutional basis under which the expansion of the industry is taking place in Africa. This will involve discussions of the institutional characteristics of Africa, including issues of land tenure and property rights laws, how institutional systems are changing in order to facilitate the industry's expansion, and the repercussions of these changes upon society. The course also interrogates the relevance of international efforts to mitigate some of the adverse impacts of the industry. Among such efforts is the UN Guiding Principles for Business and Human Rights. Overall this seminar examines the industry's impact on Africa's socioeconomic development and global relations, and concludes with how African countries might deal with the adverse impact of the Oil and Mining industry.

Cross-listed with: AFR 534, INTAF 534

PLSC 540: American Government and Politics

3 Credits

Survey of basic literature in major fields of U.S. government: public opinion, parties, voting, interest groups, presidency, congress, judiciary.

PLSC 541: American Political Institutions

3-9 Credits/Maximum of 9

Research on a selected topic in United States political institutions such as the presidency, the courts, congress, bureaucracy, state governments.

PLSC 542: American Political Behavior

3-9 Credits/Maximum of 9

Research on a selected topic in United States political behavior such as public opinion, voting, parties, socialization, judicial behavior.

PLSC 543: Political Representation

3 Credits/Maximum of 9

An examination of significant concepts, ideas, and research questions addressed in recent and classic studies of political representation. PL SC 543 Political Representation (3) This seminar will investigate significant concepts, ideas, and research questions addressed in recent and classic studies of political representation. It will take up questions and issues central both to an understanding of American politics and to an assessment of the nature and quality of democratic governance: how are citizen interests represented and how responsive is government to citizen preferences? The seminar begins with an investigation of different types of political representation, some of which are policy-related and others of which are not rooted in public policy. It next takes up assessments of the relationship between citizen preferences and public policy (policy responsiveness); biases and inequality in representation; and the role of political intermediaries, namely organized interests and political parties, in facilitating the representation of citizen interests. The implications of a more or less representative political system are then examined. Throughout the seminar, attention is paid to how political scientists formulate and execute research on political representation, as well as to how the design of such research affects what is known about representation. Seminar participants will be required to engage in extensive careful reading, contribute to weekly discussion, prepare short written critical responses to the readings, and complete an original research project that takes up questions relevant to our understanding of representation.

PLSC 544: Race and American Politics

3 Credits

In this seminar, we will explore what race is, why it matters, and how it shapes attitudes, behaviors, policies, and institutions. While this is a political science course, the seminar draws ideas and insights from a broad array of disciplines in the social sciences and humanities. It demonstrates that an explicit consideration of race is needed to fully comprehend American politics. Students emerge from the course with an understanding of the scholarly approaches and key substantive debates.

Cross-listed with: AFAM 544

PLSC 550: Comparative Politics: Theory and Methodology

3 Credits

Survey of basic literature and major research efforts in comparative political analysis.

PLSC 551: Comparative Political Institutions

3 Credits/Maximum of 9

Comparative study of the institutional structures of different political systems: the state, party systems, administrative structures.

PLSC 552: Comparative Political Behavior

3 Credits/Maximum of 9

Research on aspects of comparative political behavior, such as political culture, political change and development, interest groups, public opinion. PL SC 552 Comparative Political Behavior (3 per semester/maximum of 9) This course will explore the nature of social movements and revolutions. We will look at the major theories that sociologists and political scientists have created to explain the development and outcomes of social movements and revolutions. How do we explain why people participate in revolutions or social movements? Why is it that some people never revolt although observers would say they are as bad off as others that do? What sorts of factors determine the tactics people will use once they decide something must be done? Can governments repress revolutions or social movements? What determines whether a social movement or revolution is successful? In examining these questions we will read theoretical works, quantitative studies comparing many different social movements or revolutions, and case studies of particular social movements and revolutions. By the end of this course, you should have a good grasp of the theoretical debates about social movements and the methods which have been used to study revolutions and social movements, and you will have cursory knowledge of several different revolutions and social movements ranging from the French Revolution to the American Civil Rights Movement. Precise content will vary in subsequent offerings of the course, as determined by instructor. Students will consult with instructor prior to taking the course additional times.

PLSC 553: Comparative Racial and Ethnic Politics

3 Credits

Since its founding, the United States has had to balance the American creed of equality for all, on one hand, with racial inequality, on the other hand. Is this challenge something exclusive to the United States? This course will provide students the opportunity to analyze how race and ethnicity are constructed across the globe as well as how race and politics interact across state borders. Students will examine how race is constructed and racial ideologies are developed in several countries including the U.S., South Africa, France, Australia and Brazil. By the end of the semester, students should be able to fully engage and contribute to broad literatures on the politics and policy of race and racism. They should readily be able to answer questions such as: What role do countries and their institutions play in developing racial ideologies and racial hierarchies? What political purpose do ideologies such as "racial democracy" serve? How might social scientists best compare notions such as U.S.'s "race problem," Latin America's "shade problem" and Europe's "immigrant problem"? What are the perils of cross-border comparisons, and how, if possible, can social scientists account for state differences in their analyses? The major objectives of the course are to: (1) analyze the effects of historical, social, economic, cultural and global forces on the development of racial and ethnic politics in various countries; (2) define and critically analyze concepts relevant to the study of racial and ethnic politics; (3) identify, critique and apply major academic theories and debates regarding issues of race, ethnicity, inequality and reconciliation; (4) build analytical skills so that students will be able to effectively engage and communicate in public and scholarly discourse about race and ethnic politics; (5) improve writing skills, especially as they relate to manuscript and book reviews; (6) become cognizant of the difficulties that scholars must navigate as they approach topics related to the politics, race, ethnicity as well as comparative/cross-state analysis; and (7) develop a series of

best practices to address methodological and theoretical challenges to studying race comparatively.

Cross-listed with: AFAM 553, PPOL 553

PLSC 555: Comparative Regimes

3 Credits

This course provides an overview of comparative analyses of regimes as they relate to the field of political science. PL SC 555 Comparative Regimes (3 per semester/maximum of 9) This course focuses on the comparative study of particular types of regimes, including democracies and authoritarian regimes. It is designed for Ph.D. or M.A. students who have completed the foundational graduate statistical methods courses. The course examines current research on both the institutional structures of different political systems (e.g. the state, party systems, administrative structures) and on aspects of political behavior (such as political participation, interest groups and social movements, public opinion). Topics include theories of regimes, measures and typologies of regimes; formal theories of regimes; political institutions (legislatures, parties, and elections); political behavior; consequences of regimes for economics; and regimes place in current international relations research. Building on this literature, students will be expected to conduct replications or original research focused on these regimes.

PLSC 556: Civil Conflict

3 Credits

This class addresses civil conflict, in terms of general theory regarding cooperation and conflict and also cross-regional cases of civil conflict.

PLSC 560: International Relations: Theory and Methodology

3 Credits

Survey of major traditional and contemporary theory-building efforts and contemporary research techniques and orientations in international relations.

PLSC 561: American Foreign Policy

3 Credits/Maximum of 9

Research on the institutions, dynamics, and major themes of United States foreign policy. PL SC 561 American Foreign Policy (3 per semester/maximum of 9) This course is an advanced option for graduate students in political science studying international relations. The course surveys important themes in U.S. foreign policy, including how that policy is made, the implementation of policy, and critiques of U.S. foreign policy. Precise content will vary in subsequent offerings of the course, as determined by instructor. Students will consult with instructor prior to taking the course additional times.

PLSC 563: International Political Economy

3 Credits/Maximum of 9

Research on international political economy with a focus on theory building; analysis of political causes and consequences of economic behavior. PL SC 563 International Political Economy (3 per semester/maximum of 9) This course is a graduate seminar on international political economy. Topics covered include the major theoretical perspectives in international political economy and the political economy of international trade, finance, investment, and monetary policy. The

aim is to familiarize students with theoretical and empirical literature in the field of international political economy. Students are expected to engage in constructive dialogues across the disciplinary boundaries of economics and political science, across different research methods, and among themselves, with the goal of producing publishable work. Precise content will vary in subsequent offerings of the course, as determined by instructor. Students will consult with instructor prior to taking the course additional times.

PLSC 565: International Conflict

3 Credits

Research into the causes and consequences of international crises and wars, using various methodologies for theory assessment.

Prerequisite: PL SC560

PLSC 566: Conflict Management, Termination, and Bargaining

3 Credits

Research on termination and resolution of international conflicts, focusing on theory building and empirical assessment of theories of conflict resolution. PL SC 566 Conflict Management, Termination, and Bargaining (3) This graduate seminar introduces and examines the dominant theories, hypotheses, and research concerning the termination and resolution of international and civil wars. Topics include international mediation, rational bargaining theory, conflict resolution vs. termination, third party intervention, peacekeeping, and peace duration. The focus is theoretical and research oriented; arguments about the causes of conflict resolution are assessed both logically and empirically, using both case study and statistical methods. The course examines whether and how theories of conflict management have been tested, and allows/encourages students to develop their own testable hypotheses about conflict management and termination. Existing research (primarily from political science, but also drawing on economics) is evaluated on its merits, and students then seek appropriate ways to extend that research.

Prerequisite: PL SC560

PLSC 567: Terrorism

3 Credits

This seminar provides a general and cumulative investigation into the phenomenon of terrorism from a Political Science perspective. It is a study of terrorism with an attention to what it is 'theoretically, conceptually, empirically' and how and why it is used by nonstate actors; its political, economic, and social root causes; its consequences to political, economic, and social institutions and outcomes; and the implications of current research on terrorism and counterterrorism. Although the study of terrorism has a long pedigree in the social sciences, research by political scientists became more extensive following the September 11, 2001 attacks on the World Trade Center. This course critically evaluates this new literature, noting its contributions, limitations, gaps, and opportunities for future discovery. Much of the contemporary scholarly literature on terrorism makes use of state-of-the-art political science research methods and quantitative analysis.

Cross-listed with: INTAF 567

PLSC 568: Psychology of Terrorism

3 Credits

This course examines the causes and consequences of terrorism, and the responses to terrorism from a psychological perspective, to include Christian extremism, Islamic Fundamentalism, Jihadism, Left wing extremism and Marxist terrorism, Right wing extremism, and single-issue terrorism. It draws on research from a variety of disciplines in order to examine terrorist ideologies; the motives, strategies, and behaviors of terrorists and terrorist leaders; how people come to join terrorist groups; methods of recruitment; terrorist tactics; the psychological consequences of terrorism on individuals, communities, and global societies; psychological counterterrorism; reactions to counterterrorism efforts; terrorism prevention; and possibilities for disengagement and deradicalization.

Cross-listed with: INTAF 568, PSY 568

PLSC 569: Counterterrorism

3 Credits

This course investigates the topic of counterterrorism. It surveys the history and evolution of counterterrorism campaigns, strategies, and tools using relevant scholarly and professional literature on the subject as well as contemporary and practical case studies that explore the application of counterterrorism. It begins with an examination of the current status of U.S. counterterrorism and the institutions and agencies that conduct counterterrorism. The course then moves into a discussion of specific counterterrorism strategies and tactics, ranging from military interventions to the use of community outreach, development, culture, and soft power. The course examines the challenges posed by network and clandestine structures of terrorist threats to counterterrorism officials, as well as the ethical implications of counterterrorism efforts. The comparative focus of the course is used to inform contemporary U.S. counterterrorism with the lessons learned from historical and contemporary counterterrorism campaigns waged by other states such as the United Kingdom, Israel, Turkey, France and Colombia.

PLSC 581: History of Political Theory

3 Credits/Maximum of 9

Research on selected political theorists or historical traditions of political thought. PLSC 581 History of Political Theory (3 per semester/maximum of 9) This seminar is a survey of American political thought. The course is designed (1) to introduce students to sources and techniques in researching and writing the history of political thought and (2) to prepare its participants for teaching American political thought courses to undergraduates. We will discuss a variety of persuasive works (sermons, speeches, essays, autobiographies, poetry, plays, films, etc.) to examine how Americans have conceptualized key political ideas (e.g., equality, liberty, autonomy, community, progress, the American dream) and how their views on the proper organization of political society have changed from the seventeenth century to today. We will pay particular attention to the tradition of dissent in American political thought, and the corresponding political and social movements that have been built on demands for "liberty and justice for all." Precise content will vary in subsequent offerings of the course, as determined by instructor. Students will consult with instructor prior to taking the course additional times. This course will be offered once a year with 16 seats per offering.

PLSC 583: Modern Political and Social Theory

3 Credits/Maximum of 9

Research on major developments and issues in modern political and social theory, such as critical theory, modernism, and postmodernism. PL SC 583 Modern Political and Social Theory (3 per semester/maximum of 9) This course will survey recent versions of liberal theory as well as critical appraisals of that tradition. Particular attention will be paid to the developments of liberalism in the most recent work of Rawls and Habermas. We will then consider critical appraisals of liberalism arising from various corners: communitarianism, identity politics, and post-modernism. Throughout, we will explore themes concerning the grounds of political theorizing and normative justification, models of the self and the person presupposed in political theories, questions of individualism and collective identity, and the very possibility of stable meanings and generalized theory construction. Precise content will vary in subsequent offerings of the course, as determined by instructor. Students will consult with instructor prior to taking the course additional times. This course will be offered once a year with 12 seats per offering.

PLSC 586: Theory of Bureaucratic and Administrative Politics

3-6 Credits/Maximum of 6

The role of the executive in government and politics; theories of administrative organization, organization behavior, and decision-making processes.

PLSC 594: Research in Political Science

1-6 Credits/Maximum of 6

Supervised student activities on research projects identified on an individual or small group basis.

PLSC 595: Internship in Political Science

1-9 Credits/Maximum of 9

Supervised off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

Prerequisite: Prior consent of supervisor, advisor, or department head; applicable departmental internship requirements such as satisfactory completion of required upper level courses appropriate for the internship program selected.

Cross-listed with: SOC 595

PLSC 595A: Survey Research Practicum

1-6 Credits/Maximum of 6

Practicum in Survey Research data collection or management.

Prerequisite: PL SC518 or SOC 518 and PL SC519 or SOC 519
Cross-Listed

PLSC 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses. A specific title may be used in each instance and will be entered on the student's transcript.

PLSC 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

PLSC 598: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

PLSC 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

PLSC 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

PLSC 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

No description.

PLSC 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

PLSC 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

PLSC 805: Violence, Threats, Terror, and Insurgency

3 Credits

This course examines political violence committed by non-state groups as it applies to homeland security from both a domestic and global perspective.

Cross-listed with: CRIM 805, HLS 805

PLSC 836: Root Causes of Terrorism

3 Credits

Investigates the role economic, political and social factors play in determining patterns of international and domestic terrorism and terrorist activity.

PLSC 837: Radicalization, Counter-Radicalization, and De-Radicalization

3 Credits

This course examines the communicative, social, and psychological factors related to individual and mass trajectories into and out of

engagement in terrorism and other forms of political violence. It investigates the factors that promote the radicalization process, as well as the theoretical and practical foundations of efforts at counter-radicalization and de-radicalization both in the United States and abroad. With an emphasis on the persuasive strategies employed by terrorist groups and counter-terrorist forces (including government officials, analysts, and community outreach organizations), the course explores the social and psychological processes that move an individual towards engagement in political violence; the conceptual distinctions between radicalization, violent radicalization, counter-radicalization, and de-radicalization; the specific efforts designed and implemented by counter-terrorist forces meant to prevent violent radicalization; existing programs and initiatives designed to divorce an individual from his/her violent ideology; and the question of whether radicalization is fundamental to terrorism.

PLSC 838: Tools and Analysis of Counterterrorism

3 Credits

This course explores the various resources and analytical techniques available to terrorism and counterterrorism experts today. It gives students an overview of the major sources of data on terrorist groups, terrorist incident reports, risk climates, and legal and criminal justice data surrounding terrorism and counterterrorism. It provides students with critical data gathering and analysis skills useful to practitioners, and engages them in reporting and threat briefing exercises. The course begins with an overview of the resources available to counterterrorism professionals, including information and data on terrorist groups, terrorist incidents, legal and criminal justice data related to terrorism, data on individuals engaged in terrorism, and relevant government documents. The course focuses on how the data can be accessed, norms and practices for analyzing the data and compiling it into reports, and the advantages and limitations of the various bodies of information available.

Prerequisites: PLSC 569 or PLSC 836 or PLSC 837

PLSC 839: Domestic Terrorism

3 Credits

This course examines U.S. domestic terrorism, focusing on its roots, the contemporary threat landscape, responses to it by law enforcement and policymakers, and the nature and form of extremist violence perpetrated by U.S. domestic actors and movements. Topics include how U.S.-based terrorism is defined; the historical roots of U.S. domestic terrorism; the current domestic terrorism threat landscape; organizational versus individual terrorist activities; the relationship between violent and non-violent extremist groups/movements; pathways of radicalization in the U.S. context; counterterrorism tools for domestic actors; and policy responses to domestic radicalization. A series of case studies provide for an in-depth examination of key domestic extremist movements.

Portuguese (PORT)

PORT 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

PORT 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

Psychology (PSY)

PSY 501: Seminar in General Psychology

1 Credits

Orientation course for first-year graduate students in Psychology.

Prerequisite: graduate standing in the Psychology Department

PSY 502: Health: Biobehavioral Perspectives

3 Credits

Introduction to the role of psychology in maintaining health and in treating nonpsychiatric disorders.

Cross-listed with: BBH 502

PSY 507: Analysis of Psychological Data I

3 Credits

Overview of analysis techniques for psychological data. PSY 507 Analysis of Psychological Data I (3) Research in psychology employs a variety of methods, many of which are unique to the study of the mind and behavior. This course assumes some familiarity with psychological research and concerns the analysis of psychological data, including the results from self-report and observational studies, factorial and repeated-measures experiments, and designs that mix two or more types of factor or measure. An introduction to the current methods of describing and reporting psychological data will be provided, as will a primer on the special issues surrounding data reduction and measurement error that arise when working with human subjects.

Prerequisite: graduate standing in psychology

PSY 508: Analysis of Psychological Data II

3 Credits

Overview of advanced analytic techniques for psychological data. PSY 508 Analysis of Psychological Data II (3) This course deals with the analysis and interpretation of multivariate data of the sort often obtained in psychological research. It discusses data analysis when there are multiple independent variables (e.g., various applications of multiple regression), when there are multiple dependent variables (e.g., multivariate analysis of variance), and when the aim of the data analysis is to understand the latent structure of a set of variables (e.g., factor analysis, structural equation modeling). The course uses a number of data-analytic platforms, focusing on: (1) using SPSS syntax to structure complex analyses, and (2) using AMOS to carry out analyses involving both latent and observed variables.

Prerequisite: graduate standing in Psychology; PSY 507

PSY 509: Seminar in Quantitative Methods

3 Credits/Maximum of 9

The Seminar in Quantitative Methods is designed to provide a seminar experience for graduate students in Psychology and related programs. Topics will vary by semester and instructor, but will be related to quantitative methods (e.g., research design, measurement, data analysis). Each section will provide an in-depth look at different topics in quantitative methods. Although the topics covered will vary across sections, all sections are focused on achieving the following goals: - To provide students with a broad theoretical understanding of the specific topics addressed in the seminar, - To provide students with the technical skills necessary to incorporate appropriate data analytic techniques into their research projects, and - To provide students with a cursory treatment of the mathematical foundations of these topics, so that interested students have the requisite background to pursue additional training in these areas.

PSY 511: Seminar in Contemporary Psychology

1-3 Credits/Maximum of 12

Critical review of readings on a topic of current interest, either in content or methodology, within psychology. PSY 511 Seminar in Contemporary Psychology (1-3 per semester/maximum of 12) The Seminar in Contemporary Psychology is designed to provide a seminar experience for graduate students in Psychology and related programs. Topics will vary by semester and instructor. Each section will provide an in-depth look at a current area of scientific research in psychology. Assigned readings will include material from the original scientific literature (journal articles, chapters, or books). Evaluation methods vary by section, but are writing-based and typically include a combination of short writing assignments (30%), class participation (10%), and longer papers requiring library research in the original literature (60%).

Prerequisite: 9 credits in psychology

PSY 512: Developmental Cognitive Neuroscience of Adolescence

3 Credits

In this course students will evaluate a mix of foundational and cutting-edge research and theory investigating various changes during adolescence principally from a developmental cognitive neuroscience perspective. Particular emphasis will be placed on understanding the application of non-invasive neuroimaging techniques (e.g., functional magnetic resonance imaging, EEG) and the critical role these tools have played in our understanding of adolescent development. Topics to be discussed include (but will not be limited to) structural brain development, maturation in cognitive control functions (e.g., working memory, inhibitory control), as well as affective (e.g., emotion and reward processing), and social information processing. We will also examine factors contributing to adolescent decision-making and risk-taking behaviors.

Cross-listed with: HDFS 512

PSY 517: Advanced Social Psychology

3 Credits

Problems of theory and of research methods with emphasis on persisting issues relevant to contemporary developments in social psychology.

Prerequisite: PSYCH420 ; PSYCH200 or STAT 200

PSY 520: Seminar in Psycholinguistics

3-9 Credits/Maximum of 9

Consideration of theoretical and research issues relevant to psychological aspects of language sounds, syntax and semantics, and other cognitive support. LING (PSY) 520 Seminar in Psycholinguistics (3 per semester/maximum of 9) In this seminar, psycholinguistic approaches to bilingualism will be examined. Bilingualism is of interest for a number of reasons. First, despite the prevalence of monolinguals in the United States, most people of the world are bilingual. To have a genuinely universal account of human cognition will therefore require a detailed understanding of the relations between language and thought in individuals who speak and understand more than one language. It will be essential that research on basic cognitive functions in bilinguals examines both the course and the consequence of second language acquisition. Second, bilingualism provides a unique vantage point from which the relations between thought and language may be viewed. Historically, this issue was the focus of the debate over the Whorfian hypothesis (i.e., does language determine thought?). In contemporary psychology, it has emerged as a central issue in the debate over modularity. Understanding the form of language and memory representation in the bilingual may provide an important set of constraints in modeling the fundamental categories of the mind. Finally, bilingualism can provide a research tool for examining cognitive functions that are sometimes impenetrable within an individual's first language. The examination of the mapping of form to meaning in Constructing syntactically well-formed sentences in two languages with contrasting syntax, or in understanding the meaning of words that have similar form but differ in meaning in two languages, provides a tool for developing converging sources of evidence to test theories of language comprehension and memory. Topics to be covered include second language acquisition in children and adults, language comprehension and memory in second language, code switching and language mixing, the consequences of bilingualism, and the neuropsychology of bilingualism.

Cross-listed with: LING 520

PSY 521: Cognitive Studies

3 Credits

Survey of theories, methods, and issues in cognitive science.

Prerequisite: PSYCH456

PSY 522: Personnel Selection and Appraisal

3 Credits

Evaluation of models for personnel selection, placement, and performance appraisal in business and industry.

Prerequisite: PSYCH404 , PSYCH482

PSY 523: Social-Organization Psychology in Industry

3 Credits

Analysis of the role of social and organizational variables as they affect employee performance and employee attitudes.

Prerequisite: PSYCH484

PSY 524: Proseminar in Cognitive Psychology

3 Credits

An historical introduction to theories and critical findings in the field of cognitive psychology.

Prerequisite: graduate standing in the Psychology Department

PSY 525: Cog Psy Sem

3 Credits/Maximum of 12

An advanced seminar in a topical or research area in the field of cognitive psychology.

Prerequisite: graduate standing in the psychology department

PSY 526: Measurement in Human Development

3 Credits

Principles and methods for assessment of human developmental processes across the life span.

Prerequisite: EDPSY450 or PSYCH404 ; HD FS519

Cross-listed with: HDFS 526

PSY 528: Observational Methodologies for Development

3 Credits

Design and application of observational methods in developmental research.

Prerequisite: graduate student standing in HD FS or psychology

Cross-listed with: HDFS 528

PSY 529: Seminar in Child Development

1-6 Credits/Maximum of 6

Readings and reports on recent findings in child development.

Prerequisite: 6 graduate credits in child development, child psychology, or educational psychology; 3 in statistics

Cross-listed with: HDFS 529

PSY 531: Multilevel Theory, Measurement, and Analysis

3 Credits

This course is designed to provide students with an overview of multilevel theory building and testing. Issues to be discussed include: multilevel theory & multilevel constructs, multilevel measurement models including composition and compilation models, data aggregation, aggregation bias, the role of within-group agreement in multilevel measurement, cross-level inference & cross-level bias, cross-level interactions, and multilevel regression models/hierarchical linear models/random coefficient regression models. This course has three goals: 1) To provide students with a broad theoretical understanding of multilevel modeling, 2) To provide students with the technical skills necessary to incorporate multilevel data analytic techniques into their research projects 3) To provide students with a cursory treatment of the mathematical foundations of these topics so that the interested student has the requisite background to pursue advanced training in these areas.

Prerequisite: PSY 507

PSY 532: Psychological Foundations of Leadership

3 Credits

Students will examine the social and psychological processes underlying leadership in organizations. PSY 532 Psychological Foundations of Leadership (3) Emerging organizational challenges underscore the criticality of leadership in successful organizational functioning - a trend that is as true for the corporate world as it is for non-profit and governmental institutions. Underlying the need for well-trained, effective leaders is the requirement that future leaders have a fundamental understanding of the psychological processes driving successful leadership. This course provides a broad exploration of the theoretical bases for understanding leadership. Specifically, in this course, students will have the opportunity to learn about the psychological, cognitive, and social foundations underpinning leadership thinking and theory. In particular, course readings and activities will explore traits associated with leadership, psychodynamic perspectives on leaders, skills and styles used by effective leaders, contingency approaches to leadership, the role of power and influence, leader-member exchanges, team-based leadership, transformational leadership, and servant and authentic leadership. By exploring these topics, students will improve their critical thinking about their roles as leaders and expand their skillset to operate more effectively as future leaders. Students will consolidate and demonstrate their understanding of and ability to apply conceptual bases of understanding leadership to analysis of leadership situations and to improving their own capacity for leadership by participating in a number of course activities. For example, students will learn to apply their learning about course topics such as psychological perspectives on leadership to real-world examples of leadership. Moreover, students will gain a deep understanding of the complexities surrounding effective leadership by reviewing representations of leadership in popular culture and carrying out activities that require reflection on those representations. Such deep understanding will be reinforced through exposure to relevant examples, discussion, and cases that emphasize the application of leadership models and theory to practice. Final writing assignments will serve as a vehicle for students to recognize and identify concepts such as leadership styles and types of leadership and to apply them to developing reflective awareness of the psychological processes that drive successful leadership. The conceptual framework for the course will be the psychological principles guiding the development and instantiation of successful leadership.

PSY 534: Practicum in Industrial/Organizational Psychology

1-3 Credits/Maximum of 3

Supervised application of psychological principles in industrial and governmental settings.

Prerequisite: PSYCH484 , PSYCH482

PSY 535: Research Methods in I/O Psychology

3 Credits

This seminar is designed to help students develop a broad understanding of applied research by exposing them to the various research methods commonly used in Industrial/Organizational Psychology. The objectives for the course include: 1) developing a solid core understanding of the concepts underlying the research endeavor; 2) building an appreciation of the strengths and limitations of various designs and methods of

research; 3) developing the skills to apply these methods to research problems; 4) creating an understanding of the connections between theory, method, and the advancement of knowledge; 5) becoming aware of ethical issues in research; and 6) making significant progress toward the completion of the master's thesis proposal.

PSY 537: Topics in Organizational Psychology

3 Credits

PSY 537 builds on the basic learning blocks of organizational psychology in order to be on the frontiers of knowledge about multilevel and interpersonal dynamics in organizations from the employee, to the team, to the broader organization. The course objective is to gain in-depth knowledge of the theories and research evidence in an area of organizational psychology, and then to develop a novel research idea that contributes to and expands beyond existing research. Specific topics in this course include: employee emotions and motivation, employee well-being, leadership and social influence, workplace diversity, and team-level processes and climate.

Prerequisite: PSY 523

PSY 538: Psychology of Personnel Development

3 Credits

Industrial training in relation to psychological learning theory and experimental findings.

Prerequisite: PSYCH482 or EDPHY421

PSY 539: Foundations of Behavior, Motivation, and Attitudes at Work

3 Credits

Students will examine the psychological and social processes underlying behavior, motivation, and attitudes in work settings. PSY 539 Foundations of Behavior, Motivation, and Attitudes at Work (3) Ongoing changes in the nature of work (e.g., increasingly jobs are knowledge-based), the workforce (e.g., more diverse), and employee-organizational linkages (e.g., greater mobility of employees from organization to organization; increased employee responsibility for maintaining work-relevant skills and knowledge) result in increasing complexity and variability in individual motivation and attitudes at work that, in turn, lead to challenges for leaders in their attempts to influence and develop their employees. Knowledge of the many psychological factors affecting motivation and attitudes, and related skills in understanding the specific ones that may be relevant in a given organizational setting, are critical for effective leadership. This course will provide a broad exploration of research and theory concerning the psychological factors that underlie motivational and attitudinal processes related to human behavior in work and organizational settings. In particular, the course investigates both positive and dysfunctional work behaviors, and their causes and consequences; work attitudes, including job satisfaction and organizational commitment; work motivation theories, including need and trait approaches, behavioral approaches, and cognitive approaches; the role of work content and context and social factors on motivation and attitudes; the importance of aligning such factors to create a work environment supporting effective employees and work groups; and how the changing nature of work and organizations may impact the importance of these factors. The course will focus on the development of the students' ability to think critically about the complexity of factors that influence behavior and the wide range of individual differences in behavior, emotions, and thinking that occur even when individuals

experience a common work environment. Building on these insights, students will learn to recognize and identify in specific work settings the situational conditions that may enhance and/or inhibit effective employee motivation, attitudes, and behavior. Students will also develop skill in aligning various organizational programs and policies to maximize the overall positive impact on effective employee behavior. Synthesis of the various theories and sets of research findings will be developed by the use of relevant examples, cases, and discussions that allow students to demonstrate their knowledge in relation to the development of leadership behaviors likely to be effective in various organizational situations.

PSY 540: Seminar in Clinical Problems

1-9 Credits

Contemporary psychological theory, research, and methodology in relation to clinical psychology.

Prerequisite: PSY 542, PSY 560

PSY 542: Lifespan Development and Psychopathology - Adulthood

3 Credits

This course covers knowledge about typical development in adulthood and about atypicality and the development of adult psychological disorders.

Prerequisite: PSYCH470

PSY 543: Research Design in Clinical Psychology

3 Credits

Experimental and quasi-experimental designs, methodological problems, and techniques of experimental control in clinical psychology research.

Prerequisite: 3 credits of statistics

PSY 547: Fundamentals of Social Development

3 Credits

An introduction to theories, current issues, and critical psychological research findings relating to social and emotional development. PSY 547 Fundamentals of Social Development (3) This course will focus on children's social and emotional development with an emphasis on the various agents that play a part in children's socialization. An important assumption underlying this course and guiding its content is that growth in social and emotional competence emerges from children's experiences in their relationships with other people, especially parents, siblings, and friends. In addition, we will assume that socialization is bi-directional, that is, that children influence their relationships even as their relationships influence them. The goals for the course are as follows: To enhance understanding and familiarity with the methods and findings of the scientific literature on social development; to provide an understanding of the how of theory and cultural assumptions influence empirical research and how to recognize the implications of theory for research; to enhance understanding of the variability that exists among individuals in terms of social experiences and the growth and development of social competence; to develop or extend students' skills for scholarly communication by providing opportunities to make presentations and produce written work in formats that mimic those used by professionals in the field.

PSY 548: Fundamentals of Cognitive Development

3 Credits

Fundamentals of Cognitive Development will provide students with a broad background in theories, methods, and empirical findings in cognitive development. Discussions will address cognitive development across the lifespan, although empirical work will emphasize cognitive development during infancy, childhood, and adolescence. Students will study varied theoretical frameworks and methods, and will obtain experience in evaluating research from different theoretical perspectives, considering the role of diverse contexts and individuals, and addressing implications of research for applied issues such as education.

PSY 549: Developmental Theory

3 Credits

Conceptual frameworks and major contributions to the study of individual development across the life-span.

Prerequisite: 6 credits at the 400 level in individual development or psychology

Cross-listed with: HDFS 549

PSY 552: Child Maltreatment: Developmental Processes and Biological Embedding

3 Credits

The purpose of this course is to review the breadth of literature on the biological and developmental impact of child maltreatment including sexual abuse, physical abuse, and neglect on youth victims. Students will learn how to integrate child maltreatment research into a relevant, cohesive framework for understanding child maltreatment's wide-reaching effects. The biological focus of the course will be on the health consequences of child maltreatment as well as the neurological, neuroendocrine, and genetic embedding of child maltreatment. The course will also focus on the developmental antecedents and sequelae of child maltreatment through childhood, adolescence, and the transition to adulthood, including addressing how intergenerational transmission, parenting, interpersonal relationships, and attachment are associated with exposure to child maltreatment.

Cross-listed with: BBH 552, HDFS 552

PSY 553: Child Maltreatment: Policy, Administrative Data Systems, Prevention, and Treatment

3 Credits

The course will provide an overview of the major components of the child welfare system (e.g., child protection, family court, foster care, congregate care) involved in the community response to child maltreatment and promote a critical analysis of key federal policies that guide system activities. Course participants will also become familiar with Federal, state, and community data systems, and with methods to develop integrated data systems and their relevance to evaluating system outcomes and policy effects related to the child welfare system. Next, the course will give an overview of a range of experimental, quasi-experimental, and observational research designs and analytic methods relevant to evaluating the effects of child welfare policies and practices on child and family outcomes related to child maltreatment and system involvement. Finally, class participants will apply course content to develop applied research proposals that leverage administrative data for

systems research and examine methods for communicating research findings to impact policy and practice at the community and federal levels. This course will also provide an in-depth examination of the major behavioral interventions, both preventive and treatment, applied with the child maltreatment population. Students will first be given an overview of the philosophy of science and experimental methods used to establish behavioral interventions for child maltreatment. From there, students will review emerging paradigms within national funding agencies that focus on identifying and targeting mechanisms to optimize intervention effects.

Cross-listed with: BBH 553, HDFS 553

PSY 554: Clinical Assessment

3 Credits

Development of psychological measures; evaluation of reliability and validity. Predictive utility of tests in clinical settings emphasized.

Prerequisite: PSY 541 or PSY 542 ; a course in measurement

PSY 555: Theory and Practicum in Clinical Assessment

3-9 Credits

Theoretical issues and research in clinical assessment with special reference to administration and interpretation of testing procedures and clinical interviewing.

Prerequisite: PSY 541 or PSY 542 , and a course in measurement

PSY 556: Neuropsychological Assessment

4 Credits

Survey of human neuroanatomy, neuropathology, behavioral correlates of cerebral dysfunction, and the assessment of neurological disorders.

Prerequisite: PSYCH478 , PSY 554

PSY 558: Whole-Community Disaster Preparedness

3 Credits

Whole-community disaster preparedness describes a fairly wide range of issues of relevance to the homeland security mission space that essentially encompasses aspects of emergency management, such as "ensuring resilience to disasters" as one of the core missions of the U.S. Department of Homeland Security (DHS) - since after 9/11 and the creation of DHS, the Federal Emergency Management Agency (FEMA) came under the roof of DHS, forming one of its so-called department components. Academically and professionally, disaster psychology contributes an important perspective to emergency management within an all-hazards and a whole-of-community approach to homeland security. Based on a general civil security perspective, it addresses the way people perceive and experience disasters, the way they react to them, and the way they recover from them. Within this context, the course explores the psychological impact of disasters and terrorist attacks on victims, families, rescuers, and society and methods of reducing negative psychological effects. Topics covered include the perception and communication of risk, psychological effects of traumatic events, and psychological interventions to reduce harmful psychological effects of disasters.

Recommended Preparations: Prior graduate work in homeland security, emergency management, disaster research, or psychology.

Cross-listed with: HLS 558

PSY 560: Practicum in Clinical Methods

1-6 Credits/Maximum of 6

SUPERVISED PRACTICE IN THE PSYCHOLOGY CLINIC, INCLUDING ASSESSMENT, THERAPY, REPORT WRITING, AND STAFF PARTICIPATION.

Prerequisite: PSY 555

PSY 561: Clinical Practicum with Children

1-6 Credits/Maximum of 6

Diagnosis and counseling of child-parent problems of learning and adjustment.

Prerequisite: PSYCH415 , PSYCH412 , PSY 555

PSY 563: Behavior Modification I

3 Credits

Conceptual foundations of principles, assessment methods, and research strategies.

PSY 566: Multicultural Perspectives in Clinical Psychology

3 Credits

Experimental and descriptive research on culture and behavior in both Western and non-Western settings.

Prerequisite: PSYCH420 , PSYCH438 , and 6 credits of statistics

PSY 568: Psychology of Terrorism

3 Credits

This course examines the causes and consequences of terrorism, and the responses to terrorism from a psychological perspective, to include Christian extremism, Islamic Fundamentalism, Jihadism, Left wing extremism and Marxist terrorism, Right wing extremism, and single-issue terrorism. It draws on research from a variety of disciplines in order to examine terrorist ideologies; the motives, strategies, and behaviors of terrorists and terrorist leaders; how people come to join terrorist groups; methods of recruitment; terrorist tactics; the psychological consequences of terrorism on individuals, communities, and global societies; psychological counterterrorism; reactions to counterterrorism efforts; terrorism prevention; and possibilities for disengagement and deradicalization.

Cross-listed with: INTAF 568, PLSC 568

PSY 569: Advanced Theory and Practicum in Counseling and Psychotherapy

3-9 Credits

Theoretical issues, research, and practicum experience in psychotherapy.

PSY 571: Seminar in Social Psychology

3-12 Credits/Maximum of 12

Historical development of theory and methods; determinants and principles of complex social or interactional behavior; contemporary problems and research.

PSY 572: Psychology of Gender

3 Credits

Theory and research on the psychology of gender, emphasizing gender in social interaction, and in individual identity. PSY (WMNST) 572 Psychology of Gender (3) This seminar is a graduate-level introduction to the psychology of gender. Our goal is to understand what "gender" is, and how and when gender matters in our evaluations of ourselves and in our interactions with others. Gender is considered as a system of power relations, as an aspect of personality, and as a cue. The course provides a background and fundamental skills for more advanced courses on the topic or independent study. The course will serve as one of the regular seminars that students can take to meet graduate program requirements in Psychology. Students will be evaluated on preparation and participation (20%), weekly reaction papers (30%), individual research paper (30%), and class presentation on research paper or other topic (20%). This course will be offered once a year with 15 seats per offering.

Prerequisite: graduate standing in psychology, women's studies, or allied field

PSY 575: Lifespan Development and Psychopathology - Childhood and Adolescence

3 Credits

This course covers knowledge about typical development in childhood and about atypicality and the development of child psychological disorders.

PSY 576: Clinical Child Interventions

3 Credits

Clinical-child therapeutic techniques from a developmental-clinical perspective with emphasis on theoretical basis and empirical evaluation of various techniques.

Prerequisite: PSY 575

PSY 577: Clinical Child Assessment

3 Credits

Overview of major methods used in clinical assessment of infants, pre-school children, and grade-school children with emphasis on social-emotional functioning.

Prerequisite: PSY 575 , or background in psychological assessment

PSY 578: Contemporary Issues in Interdisciplinary Educational Intervention Sciences

2-3 Credits

Proseminar exploring contemporary issues in the design and evaluation of educational interventions from an interdisciplinary perspective.

Cross-listed with: EDPSY 578, HDFS 578

PSY 583: Designing Research in Social Psychology

3 Credits

Designs and procedures useful in social psychology and cognate disciplines; quasiexperimental designs and analysis, field experimentation, validity of inferences.

Prerequisite: 3 credits of 500-level statistics

PSY 584: Attitude Formation and Change

3 Credits

Theory and method in research on attitude formation and change with emphasis on critical analysis.

Prerequisite: PSYCH420 or SOC 403 ; 3 credits in statistics

Cross-listed with: SOC 584

PSY 589: Social Cognition and Social Perception

3 Credits

Overview of how social behavior and social perception (e.g., impression formation, attitudes, the self, stereotyping) are influenced by cognitive processes.

PSY 591: Seminar on Teaching Psychology

1-3 Credits

Objectives and content of psychology; organization and presentation of material; teaching aids and techniques.

PSY 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

PSY 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

PSY 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

PSY 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

PSY 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Supervised training in lecture content and presentation, examination construction, and individual instruction.

PSY 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

PSY 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

PSY 811: Global and Cross-Cultural Leadership

3 Credits

Students will examine the relation of cultural variations in psychological and social factors affecting the effective leadership of individuals and groups in work organizations. PSY 811 Global and Cross-Cultural Leadership (3) Contemporary organizations have become increasingly focused on both the global marketplace and global competition. Large organizations frequently have physical locations and employees in numerous countries around the globe, but many relatively small organizations compete on a global scale even if physically located in one or a few countries. One consequence of the global marketplace is that organizational leaders need a global mindset in order to be effective in their leadership roles, that is, an awareness of the impact of culture on factors such as work-related values, norms, and expectations such that cultural differences are an automatic part of leader and organization decision-making. This course provides a comprehensive examination of the psychological, social, and cultural factors that underlie expectations, preferences, and judged effectiveness of leadership practices and styles in organizations and work groups in the major cultural regions of the world. The course will focus on the development of the students' ability to think critically about the complexity of the direct, indirect, and interactive impact of these factors on leading within multinational organizations that operate worldwide. Considerable attention will be placed on the extensive findings of the major research effort related to global leadership, Project GLOBE, that assessed the expectations, preferences, and perceived effectiveness of a comprehensive set of leadership styles and behaviors in 3 industrial sectors in a total of 60 cultures located in all geographic regions of the world. Students will be able to use the Globe Project's framework of cultural differences and similarities related to organizational leadership to analyze specific cultural settings in terms of desired leadership approaches. Students will understand the paradoxical needs for both flexibility and consistency when attempting to lead with a global perspective. They will also be able to develop leadership approaches in their organizations that can achieve sufficient levels of both consistency across various global and cultural settings (needed for perceptions of fairness and predictability) and flexibility (necessary for adaptation to cultural and social differences). Students will also be exposed to research on the challenges faced by expatriate leaders who are given international assignments outside of their native cultures. Over the semester students will explore relevant examples, cases, and discussions that emphasize the application of psychological theory and research findings from varied cultural settings to the practice of leadership functions in global organizations and work situations. Some examples of the course material that will be addressed

include: dimensions of national culture relevant for work organizations; research on the differences and similarities of preferred and effective leadership across dimensions of cultural differences; developing a global mindset and global leaders; leading multinational and culturally diverse teams; challenges of expatriate leadership assignments.

Prerequisite: PSY 532 and PSY 539

PSY 812: Group Leadership and Effective Decision Making

3 Credits

Students will examine the influence of leadership on the psychological and social processes related to effective decision making in work groups. PSY 812 Group Leadership and Effective Decision Making (3) Contemporary organizations can easily suffer from an "information explosion" with the ready availability of large quantities of data of possible relevance to decisions and problem-solving. Psychological research has identified numerous factors that can result in work groups' failing to make effective decisions. These factors include cognitive biases and heuristics that can be employed with little or no awareness by individuals and groups, usually to simplify information processing to make a decision quickly. They also include psychosocial factors related to how decisions are influenced by conformity, social power, and overconfidence about decision outcomes. In addition, psychological research has shown that groups do not always include effectively new information into revisions of the perceived consequences of decision alternatives. Leaders can help work groups be less influenced by such factors by use of approaches that require more in-depth processing of information and that increase group member awareness of potential biases and constraints that affect decision making. This course provides a comprehensive exploration of the psychological and social factors that underlie decision making in work groups in organizational settings, and in addition emphasizes the role that group leadership plays in making these decision processes more effective. The course focuses on the development of the students' ability to think critically about the complexity of factors that influence group decision making and the range of approaches to decision making that may be effective across various types of decisions and situational contexts. Particular attention will be paid to how group members process information related to the decision at hand and make judgments about uncertain future events. Over the semester students will be exposed to relevant examples, cases, and discussions that emphasize the application of psychological theory and research findings to the practice of leadership functions in work settings that help develop effective group decision making. Building on this knowledge, students will develop the skill to recognize and identify in specific organizational settings the cognitive and psychosocial factors that may influence information processing and decision making. They will be able to draw on these insights to develop action plans for minimizing the dysfunctional effects that certain of these factors may have on decision making, while aligning leader behaviors to support group processes that encourage decision effectiveness. Students will learn how to apply principles of in-depth information processing and evidence-based analytic processes to their own decision making.

Prerequisite: PSY 532 and PSY 539

PSY 813: Leadership for Creativity and Innovation

3 Credits

Students will examine the influence of leadership on the psychological and social processes related to developing creative ideas and implementing them within work groups and organizations. PSY 813

Leadership for Creativity and Innovation (3) Organizations face continuous and strong pressures to be innovative with regard to all types of organizational functions. Creativity and innovation are not just important with regard to developing new products and services that organizations can offer to their customers, but with regard to developing more effective administrative, production, and delivery systems. At the same time individuals and groups within the organization are likely to resist change because of its inherent uncertainty and risk. Furthermore, while innovation and creativity may be strategic goals for the organization, at the same time the organization is also likely pursuing goals of efficiency, standardization, and quality that conflict with introducing change into the organization. Leaders in the organization thus face difficult paradoxes related to the achievement of multiple, conflicting goals. Organizational and work group creativity and innovation face a number of obstacles that leaders must minimize if the organization is to be successful or even survive. Leading for innovation is a critical skill in today's organizations. Students will have the opportunity to learn about the psychological and social factors that underlie creativity and innovation in work groups in organizational settings with an emphasis on the role that group leadership plays in the development and implementation of novel idea and processes. The course will focus on the development of the students' ability to think critically about the complexity of factors that influence creativity and innovation and the range of approaches to dealing with the normative resistance to change that often exists in organizations. Particular attention will be paid to how individuals and groups develop alternative potential ideas, evaluate those alternatives, and implement a novel approach to the issue at hand. Over the semester students will be exposed to relevant examples, cases, and discussions that emphasize the application of psychological theory and research findings to the practice of leadership functions in work settings that help develop and implement novel ideas. Some examples of the course material that will be addressed include: models of the creativity-innovation process within organizations; resistance to change; individual, group, and organizational factors affecting creativity; individual, group, and organizational factors affecting innovation; role of leadership in creativity and innovation; paradoxes related to concurrent need to lead for innovation and lead for efficiency; special challenges related to leading for innovation in multinational and virtual teams.

Prerequisite: PSY 532 and PSY 539

PSY 814: Psychology of Leading Work Groups and Teams

3 Credits

Students will examine the psychological and social processes related to leading work groups and teams. PSY 814 Psychology of Leading Work Groups and Teams (3) The nature of work in contemporary organizations has been changing from being performed largely by individuals to being increasingly performed by work groups and teams. Furthermore, employees are often members of multiple work groups over relatively short intervals of time or even members of several work teams at one time. Add to this trend the increasing diversity of the workforce and the increasing use of work groups that are geographically and temporally distributed around the world, and the role of being an effective work unit leader is much more difficult than it was in the past. The multiple challenges that leaders face in their attempts to influence, motivate, and develop their employees require knowledge of the psychological and social factors affecting group performance and processes, and related skills in understanding the specific factors that may be relevant in a given organizational setting. This course provides a comprehensive examination of the psychological and social factors that underlie group and team processes in work and organizational settings. The course

will focus on the development of the students' ability to think critically about the complexity of factors that influence group processes and the wide range of individual differences in behavior and emotions that can occur within a work group. Over the semester students will be exposed to relevant examples, cases, and discussions that emphasize the application of psychological theory and research findings to the practice of leadership functions in work settings that help develop effective work groups and positive intra- and inter-group relations. Particular attention will be paid to those factors that work unit leaders can directly create and maintain (such as developing and coaching individual employees and the intact team; recognizing effective work behaviors and motivation; task assignments and delegation of responsibility). Utilizing this method of deployment, students will be exposed to personal experiences of the instructor as well as those of other students, thereby encouraging the use of multiple approaches to analyzing situations and designing action plans. Emphasis will be placed on applying knowledge and theories to real world situations through both the use of case studies and discussion. Topics will range from basic definitional and theoretical framing, to critical evaluation of the utility of theories, as related to the students' goals as future organizational leaders.

Prerequisite: PSY 532 and PSY 539

PSY 815: Follower-Centric Leadership

3 Credits

Leadership research and theory most often focuses on leaders and what it takes for them to achieve results through others. However, some leadership research and theory takes a different approach by focusing more on followers and how leaders can empower those followers to achieve their own results. The purpose of this course is to explore these more follower-centric approaches to leading others, including transformational leadership, servant leadership, and authentic leadership. The course will begin with an overview of follower-centric leadership in which the concept will be contrasted with more leader-centric theories such as trait theory, authoritarian leadership, transactional leadership, and charismatic leadership. The core of the course will be divided into three units, covering transformational leadership, servant leadership, and authentic leadership. The final unit of the course will provide an opportunity for students to compare and contrast the three different approaches or styles.

Prerequisite: PSY 532 and PSY 539

PSY 816: Dysfunctional Leadership

3 Credits

Students will explore the impact of negative and destructive leader behaviors including toxic leadership, abusive supervision and leader error. PSY 816 Dysfunctional Leadership (3) Leaders face a variety of psychological, cognitive, social, and decision-making challenges in organizational life. Even the noblest leaders may be tempted by the opportunities and trappings afforded by influential leadership positions. It is necessary, then, to teach less experienced leaders about the potentially negative components of supervisory roles. As such, this course approaches the psychological processes surrounding the darker side of leadership, with specific foci on destructive leadership, toxic supervision, leader error and error recovery. The course will provide students with foundational information regarding psychological concepts of dark leadership with the aim of reducing the scope, frequency, and impact of negative leadership. Over the semester, students will be exposed to the causes and antecedents of negative leadership with a

particular focus on multilevel influences. Students will also learn means and methods of appropriately and ethically recovering from errors. Learning objectives include providing a basic understanding of what factors cause destructive leadership and how to avoid potentially pit-falling situations. Emphasis will be placed on teaching students how to assess and identify contextual factors that may drive harmful leadership influence. By applying such understanding, students will learn to limit the effect of destructive leadership on themselves and their followers.

Prerequisite: PSY 532 and PSY 539

PSY 817: Psychology of Shared and Collective Leadership

3 Credits

Students will examine the topic of shared and collective leadership, which includes the psychological processes surrounding collective, team-based, and dyadic leadership in organizations. PSY 817 Psychology of Shared and Collective Leadership (3) Given the complexity faced by leaders in organizations, it will not always be possible to operate alone as a leader. At times, it will be beneficial to share that process with one or more other individuals, hence the growing emphasis on "we-based" leadership. With psychology serving as the disciplinary framework for the course, students will have the opportunity to learn about the process and framework of shared leadership with the express goal of allowing them to utilize this, and similar, leadership processes in their own professional careers. The course will focus on providing a broad exploration of collective leadership. In particular, it will provide an understanding of the varying approaches to understanding and thinking about shared and collective leadership. In the investigation of course material, students will be exposed to real life examples and experiences - drawing heavily on instructor and student experiences as well as chosen case studies. Learning objectives for the course will center first on providing a foundation in the relatively new concept of "we-based" leadership to students. With this foundation, students will begin to apply this knowledge to understanding the conditions under which we-based approaches are most and least effective. Finally, students will be provided with a greater understanding of the contextual factors that shape the need for we-based leadership, with a focus on sustaining long-term leadership effectiveness.

Prerequisite: PSY 532 and PSY 539

PSY 818: Leadership Assessment and Development

3 Credits

Organizations use personality and other types of assessments for a variety of purposes, including employee selection, team building, and employee development. Many assessments are well-developed with extensive research to support their use for specific purposes. These assessments can add tremendous value to organizations and individuals by providing insights related to interests, traits, and other characteristics. There are also many popular personality inventories that are used for purposes that the publisher does not intend and/or that research does not support. This course will serve two primary goals. First, by educating class participants concerning the advantages and limitations of a variety of popular personality inventories and other types of assessments, students will become educated consumers, better able to make choices for themselves and their organizations concerning appropriate assessment methodologies. Second, by completing different assessments during the course, students will gain personal insights concerning their individual strengths, talents, interests, and developmental needs. Examples of the course topics

that will be addressed include: an overview of leadership competency models, including models such as Bartram's Great Eight which is used in Penn State's Leadership Assessment Center; measurement issues, including topics such as reliability and validity; strengths and limitations of different assessment techniques; multi-rater feedback, including creating and administering a short feedback survey; theories underlying different approaches to measuring personality traits and styles; how to integrate different assessment sources; setting goals; and creating a professional development plan.

Prerequisites: PSY 532, PSY 539

PSY 833: Ethics and Leadership: Psychological and Social Processes

3 Credits

Ethical decisions must be made by leaders at all levels of an organization. Thus, students in this course will have the opportunity to learn about important issues in ethical leadership that will provide a foundation of the basic principles of operating as an ethical leader in organizations. The term "organizations" is intentionally broadly defined and will include reference to business, non-government organizations, government entities, and non-profit entities. Specifically, students will be exposed to topics such as the role of psychological development in ethical decision making, theoretical foundations of choosing ethical pathways from the field of psychology, the role of personality and cognition in ethicality, developing and sustaining an ethical climate, ethics during crises, ethics in a global environment, and the psychological underpinnings of leading groups toward ethical ends. The course will be grounded in psychological theory, with particular emphasis on social, cognitive, and affective frameworks. Through the presentation and investigation of the course material, students will be exposed to the core principles of ethical leadership as well as a series of real-world case examples and experiences. In addition, students will share their personal experiences and work through the often challenging and difficult decisions that surround ethical leadership. These practical discussions will be couched and framed in the discipline of psychology. Such practical applications are intentional and aimed at providing a bridge between psychological theory and application. Building on these insights, the learning outcomes of the course will be to teach students to effectively and accurately assess complex leadership situations, possessing the capacity to make ethical decisions and take ethical action. Moreover, students will develop an awareness of key psychological principles guiding ethical choices and be able to apply such awareness to identify key barriers to leading ethically, with the intent of encouraging students to remove such barriers in organizations. Finally, students will possess the ability to teach others how to operate in ethically-bound ways, further enhancing the performance and sustainability of the organization.

Prerequisite: PSY 532

PSY 894: Capstone Experience

3 Credits

Supervised, professionally oriented student activities that constitute the culminating experience for the program.

Psychology - CA (PSYC)

PSYC 500: Ethics and Professional Practice in Psychology and Counseling

3 Credits

This course will familiarize students with the standards of ethical conduct related to research and practice in psychology and counseling. PSYC 500 Ethics and Professional Practice in Psychology (3) The purpose of PSYC 500 Ethics and Professional Practice in Psychology is to introduce students to the standards of the American Psychological Association regarding acceptable practices in research, assessments, and interventions. Relevant laws and regulations in the Commonwealth of Pennsylvania will be presented and discussed in class. This course is a required course for students admitted to the Master of Arts programs in Applied Clinical Psychology and Applied Psychological Research. Admission to one of those programs is a prerequisite for taking this course. This course is a prerequisite for enrollment in a clinical internship. The overall objectives are to familiarize students with the legal and professional standards associated with working with people as research participants, colleagues, or clients in mental health settings. Students will be expected to understand the Guidelines and Principles of Ethical Conduct in Psychology, the laws of the Commonwealth of Pennsylvania, and to be able to apply them in novel situations. Throughout the semester, students will be presented with examples of possible breeches of ethical standards, and be asked to critically evaluate the scenarios to identify the issues involved and procedures to follow to ensure compliance with accepted standards of conduct. Prior to each class, students are to write a brief paper reflecting on their understanding of the issues underlying the weekly reading assignments and critically evaluate at least one of the moral issues involved in the readings. In addition students will be expected to write an analysis of a professional situation in which two or more ethical standards appear to be in conflict, and demonstrate their critical thinking skills in coming to a resolution of the conflict. Grades will be based on two examinations, weekly commentaries on the readings, written vignette analysis, and the quality of participation in class discussion. The class will be offered once a year with an enrollment of 25 students per offering. The frequency will be adjusted if enrollments trends suggest an adjustment is necessary.

Prerequisite: admission to the Applied Clinical Psychology or Applied Psychological Research programs

PSYC 501: Cultural Competency in Psychology

3 Credits

This course will familiarize students with the need for sensitivity to individual and group differences associated with culture and ethnicity. PSYC 501 Cultural Competency in Psychology (3) PSYC 501 Cultural Competency in Psychology is intended to provide a broad perspective on some of the major ways in which people are different from one another. This course will demonstrate some of the ways in which one's heritage interacts with individual differences and impacts on the person's beliefs, attitudes, and behaviors. The overall objectives of this course are to increase sensitivity to diversity issues, assist students in recognition of their own cultural biases, and lay the groundwork for learning to work with people who are different from one's self. Appreciation for both individual and population differences, and learning to work effectively with those differences, are the goals of this course. PSYC 501 is a required Psychology Core course in both the Applied Clinical Psychology

and Applied Psychological Research programs. It is intended to raise awareness of the fundamental issues with which researchers and mental health professionals need to be attentive to as the population increases in diversity. This course will provide a perspective on population issues which impact on the entire field of psychology, and thus should be taken early in the program of study. Admission to either the Applied Clinical Psychology or Applied Psychological Research program is a prerequisite for this course. Students in related areas may request permission of the instructor to register for this class on a space available basis. Students will be evaluated on the quality of their class participation, examination performance, and a major research paper covering issues relevant to working with people who are from a different background than the student. The course will be offered annually with an enrollment limit of 25 students.

Prerequisite: admission to the Applied Clinical Psychology or Applied Psychological Research programs

PSYC 502: Applied Social Psychology

3 Credits

An examination of social psychological applications to areas such as health, law, interpersonal relations, environment, politics, and other social issues.

PSYC 510: Human Development and Growth

3 Credits

The course covers human development across the life span. PSYC 510 Human Development and Growth (3) The course is designed to meet the requirements for Pennsylvania Mental Health Counselor licensure. The course will review methods of developmental and lifespan research, and encourage critical analysis of developmental research. In addition, a research paper either reviewing a significant development process, or proposing significant development research will also be required. The course will be offered annually with an anticipated enrollment of 25 students. It will be offered more often if enrollment patterns warrant such an increase.

Prerequisite: Admission to the Applied Clinical Psychology program or permission of the program.

PSYC 514: Preventive Psychology

3 Credits

This course focuses on the theoretical, conceptual, programmatic, and empirical issues currently in preventive psychology.

Prerequisite: admission to program

PSYC 515: Clinical Health Psychology

3 Credits

This course examines wellness maintenance, early detection, and the impact of health care on individuals and the community.

Prerequisite: admission to program

PSYC 516: Child Health Psychology

3 Credits

This course will familiarize students with health issues in the context of child development and family systems. PSYC 516 Child Health Psychology (3) PSYC 516 Child Health Psychology provides an overview of the major threats to the health and well-being of children and youth, in the context of child development and family systems theories. Health psychology adheres to the biopsychosocial model, which means that the course will stress how biological, psychological, and social factors interact to maintain wellness or foster illness. The focus will be on primary prevention of illness and injury wherever possible, including accident prevention and fostering healthy lifestyle behaviors such as good nutrition and exercise. When illness or injuries occur, they will be discussed in the context of the child's development. Comprehension of the illness is influenced by the child's cognitive abilities, social development, prior experience with illness, and family response. Examination of how developmental processes impact on the illness and the illness impacts on the developmental processes will be a theme underlying all the health threats studied. This is a required course for students in the M.A. in Applied Clinical Psychology program who elect the Health Psychology concentration. The overall objectives are to provide a background for development of programs to maintain health and wellness in children and youth, to facilitate the understanding of the impact of illness and disability on children and their families, and to prepare students to work with children and families in a medical environment. Grades will be based upon two examinations, a prevention proposal, an analysis of the literature relevant to an illness or injury from both the biopsychosocial and developmental perspectives, and class participation. The class will be offered biennially, with an enrollment limit of 25 students. The frequency will be adjusted if enrollment trends suggest an adjustment is warranted.

Prerequisite: admission to the Applied Clinical Psychology program

PSYC 517: Psychopathology

3 Credits

A broad spectrum view of psychopathology including biological, social, cognitive, psychological, and neuropsychological approaches, is emphasized, with an applied focus. PSYC 517 Psychopathology (3) This course will cover a broad spectrum of all aspects of psychopathology including the earned, social, biological, emotional, cognitive, affective, and cultural factors, which may be relevant to the understanding and diagnosis of mental disorders. The varied theoretical views of abnormal behavior and psychopathology will be critically reviewed, with emphasis on the current dominant theories. Approaches reviewed will include biological, behavioral, social, cognitive, psychological, existential, medical, and neuropsychological theories. Students will learn to make differential diagnoses based on the current Diagnostic and Statistical Manual and to code the disorders appropriately. Successful completion of the course requires the demonstration of competence in understanding the nature of psychopathology. Psychopathology is a required course for students in the M.A. in Applied Clinical Psychology program, and is restricted to students in the M.A. in Applied Clinical Psychology program. This course will be a prerequisite for PSYC 518, 519, and 540. The objectives of this course are to prepare students for working with a variety of clients in therapeutic settings. Methods of evaluating student performance will be explained on the syllabus, and may include components such as examinations, written papers, oral presentations, videotaped and live demonstrations of diagnostic role plays, and other in-

class exercises. This course is offered once a year with an enrollment limit of 15 students.

Prerequisite: admission to program

PSYC 518: Interviewing and Counseling

3 Credits

This course covers basic clinical interviewing and counseling techniques from both the didactic and experiential perspectives. PSYC 518 Interviewing and Counseling (3) In this course students will begin to practice eliciting information from classmates, or volunteer undergraduate students, simulating individuals presenting with a variety of issues, use that information to make an appropriate diagnosis, and work with their mock client to set goals and develop a concrete plan to achieve those goals. Guidelines for report writing will be presented. Students will submit an initial draft of a report based on the first interview session, and a full report of the client contact from initial interview through implementation of treatment plan and discharge.

Prerequisite: admission to the Applied Clinical Psychology program

PSYC 519: Theories and Models of Psychotherapy

3 Credits

An advanced level of psychotherapies and applications in diverse settings. PSYC 519 Theories and Models of Psychotherapy (3) It is a required course for students in the M. A. in Applied Clinical Psychology program. The objectives of this course are to prepare students for working with a variety of clients in therapeutic settings. Students will be evaluated on written papers and in-class exercises.

Prerequisite: PSYC 518

PSYC 520: Research Methods

3 Credits

This course is intended to provide students in the Applied Psychology Clinical program with a basis for understanding psychological research methodologies. The course will serve as a starting point for developing their master's project (PSYC 530), which is the culminating research experience for the Applied Clinical Psychology program. The course will begin with development of research questions and explore how to appropriately search research databases for previous literature on topics of interest. The course will also focus on developing ethical foundations for research through review of case studies and discussion of ethical principles and codes for psychologists. Students will also focus on understanding how different methodologies function in relation to psychological research including, but not limited to: experimental designs, quasi-experimental designs, program evaluation, within or between subject designs, and systematic literature reviews. In addition to developing an understanding of research methodologies, students will also explore how to interpret and write-up statistical results for academic manuscripts.

Prerequisite: admission to program

PSYC 521: Statistics

3 Credits

The nature, computation, computer analysis, interpretation, and APA-style write-up will be discussed for a number of statistical tests. PSYC 521

Statistics (4) This course is intended to provide students in the Applied Psychology program with the statistical skills they will need to be applied masters-level psychologists. The course will follow PSYC 520, the graduate research methods course, and will be a prerequisite for PSYC 530, the masters paper. The course will begin with a review of basic statistical methods. Since the more advanced statistical techniques are extensions of these basic tests, it is crucial that students have a firm grasp of the latter before being exposed to the former. For each test, the conditions of use, the nature of the null and alternative hypotheses, computation of relevant test statistics, interpretation of results, test assumptions, strength of the relationship, SPSS analysis, reading SPSS output, and APA Results section writeup will be discussed. Much of this is advanced material that students will not have encountered in their previous statistics courses. The course will then continue with a discussion of the following advanced techniques: nonparametric statistics, analysis of covariance, one-way repeated measures analysis of variance, factorial analysis of variance, and multiple regression. In addition, students will be introduced to such multivariate techniques as factor analysis and MANOVA. The information noted above will again guide the class presentations. Consistent with the applied nature of the program, the goals of this course are for students to become good consumers of the types of statistical information they are likely to encounter in their work, to be able to select and apply the appropriate test when called on to analyze data, and to be able to generalize their basic statistical skills to new techniques, as necessitated by their career demands. Evaluation will consist of some combination of assignments and examinations, as determined by the instructor. This course will be required of all Applied Psychology students, and will be made available to other qualified students on a space-available basis, with permission of the program. This course will be taught once every academic year. Expected enrollment is approximately 15 students.

Prerequisite: PSYC 520

PSYC 524: Biological Basis of Behavior

3 Credits

This course focuses on biological determinants of behavior, including evolution, hormones, sensory systems, internal states, reproduction, emotions, learning, and memory. PSYC 524 Biological Basis of Behavior (3) PSYC 524 Biological Basis of Behavior is intended for graduate students majoring in psychology. This course focuses on the biological determinants of behavior. Students will learn the major theories underlying research in biological psychology, including such topics as neuroanatomy and brain anatomy, evolution, behavior genetics, hormones and reproductive behavior, sensory systems, internal states, emotions, learning, and memory. Students will be taught to use critical thinking skills when interpreting and evaluating research in biological psychology. Students will use these skills and knowledge gained during the semester to develop a research proposal or integrative review paper on a biological psychology topic. Students will initially learn basic neuroanatomy and brain anatomy as a basis for understanding more complex biological behavior. The remainder of the semester will cover theories underlying more advanced topics in biological psychology. Students will learn how genes, hormones, and neurotransmitters determine some behaviors. They will also learn how biology interacts with the environment to produce behaviors such as reproduction, emotion, learning, and memory. Examinations will include questions designed to ascertain students' knowledge of the theories covered in class as well as critical thinking skills used to interpret and evaluate research in biological psychology. During the course of the semester, students will use the knowledge they have gained to a) formulate a research question based on

a topic covered in class; b) perform a literature search on the topic; and c) design a research proposal or integrative review paper based on the topic. Writing the paper will give students experience in formulating research questions, evaluating research critically, and writing in APA (American Psychological Association) style.

Prerequisite: admission to the Applied Clinical Psychology or Applied Psychological Research programs

PSYC 525: Forensic Psychology

3 Credits

This course will explore social, cognitive, civil and criminal issues related to forensic psychology. PSYC 525 Forensic Psychology (3) The purpose of PSYC 525 Forensic Psychology will be to explore the general principles of forensic psychology. Social Psychological, clinical and cognitive processing theories will be examined as they pertain to the legal system. This course will include a brief overview of the judicial system. Competency issues will be defined, and the clinical assessment of competency will be examined in the course. Specific competency issues will include competency to stand trial, to plead, to confer and to testify. There will be an overview of the insanity defense, describing the history and contemporary status of the defense. Issues such as automatism, unconsciousness and diminished capacity will be explored. The contribution of the mens rea and intoxication will be described. M'Naughton rules and the ALI rules for insanity will be described. Evaluation techniques for forensic assessments will be described and role-played by the course participants. Interview techniques, developmental and historical information gathering, and psychological testing will be reviewed in terms of utility for the forensic evaluation. Special issues such as amnesia, recovered memories, and malingering will also be covered in the course. Other issues including assessment of dangerousness, and civil commitment will be reviewed. The rule of the expert and the status of scientific information in the forensic context will be described.

Prerequisite: admission to the Applied Clinical Psychology program

PSYC 530: Research Paper

3 Credits

Supervised research in psychology for degree candidates.

Prerequisite: PSYC 520 , PSYC 521 , and permission of the program

PSYC 535: Behavioral Management

3 Credits

Analysis of determinants of behavior and behavioral ecology. Emphasis on data collection and data evaluation techniques.

PSYC 540: Group Interventions

3 Credits

This course covers applications of psychotherapeutic techniques to a group setting. PSYC 540 Group Interventions (3) This course introduces the application of therapeutic techniques to a group setting. Selection and formation of groups, leadership skills, and group process will be examined. Adaptations required for specialized groups, such as children and adolescents, will be presented.

Prerequisite: PSYC 518

PSYC 571: Tests and Measurements

3 Credits

Administration, analysis, and interpretation of psychological evaluation methods will be reviewed. PSYC 571 Tests and Measurements (3) This course builds on the critical appraisal of the nature of psychological evaluation and allows the student to develop sound abilities in the administration and interpretation of psychological instruments.

Prerequisite: permission of the Applied Clinical Psychology program

PSYC 572: Neuropsychological Assessment

3 Credits

This course will review the biological bases of behavior, emphasizing brain-behavioral relationships and assessment of these relationships. PSYC 572 Neuropsychological Assessment (3) Neuropsychological Assessment builds on the assessment skills introduced in PSYC 571, Tests and Measurement . Test batteries designed to measure neuropsychological functioning such as the Halsted-Reitan Neuropsychological Battery, the Wechsler Memory Scales, and the Woodcock-Johnson Test of Cognitive Ability will be taught. Evaluation will be based upon demonstrations of skills in test administration and scoring, written examinations, and written assignments such as assessment reports. This course is offered in the fall of odd numbered years, more often if enrollment patterns warrant, with an enrollment limit of 15 students.

Prerequisite: PSYC 524 , PSYC 571

PSYC 573: Career Counseling: Research, Assessment, and Intervention

3 Credits

This course is designed to acquaint students with the knowledge of career counseling theories, assessments, and methods based in psychological research, acquaint students with the use of empirically-supported career assessment instruments, increase knowledge to work with clients of different ages, races, ethnicities, socioeconomic classes, and genders, and discuss current issues, trends, and ethics in the field of career assessment and counseling. Students will learn about commonly used psychological theories that are applied to career assessment, including trait-oriented theories, social learning and cognitive theories, developmental theories, person-in-environment theories, career counseling-specific models, and integrative theories. Students will learn the process of assessing clients' vocational and professional interests through the use of both formal assessment instruments and interviews. Assessment techniques will include structured interviews, standardized assessment, psychological inventories, self-assessment, computerized assessment, case conceptualization, and report writing. Developmental considerations, as well as issues of cultural sensitivity and gender will be discussed. Approaches to integrating this information into career advising and/or psychotherapy will be explored. By the end of the course, students will demonstrate an understanding of the major theories of career development; be able to explain the structure of occupations, and individual and societal issues in career development, including multicultural and gender issues; summarize the relationships among personality, occupational choices, and occupational success; identify the major sources of career and educational information available through the Internet, computer-based guidance systems, and printed materials; administer and interpret printed and computer-based assessments

of career interests, beliefs, and values; integrate career development theory and assessment results with empirically-supported career counseling interventions; and describe the professional process of career assessment and advising, as integrated into psychological services.

PSYC 594: Research Topics

1-18 Credits/Maximum of 18

Supervised student activities on research projects identified on an individual or small group basis.

PSYC 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

PSYC 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

PSYC 841: Couple and Family Theories and Therapeutic Interventions

3 Credits

This course will provide a foundation for understanding couple and family systems theories, assessments, and interventions. The course will have theoretical and practical applications of couple therapy and family therapy.

Prerequisite: PSYC 518 and enrollment in the Clinical Psychology program.

PSYC 843: Trauma-Focused Approaches to Psychological Intervention I

3 Credits

This course covers the etiology, symptoms, diagnosis, and treatment of trauma-related dysfunction, particularly post-traumatic stress disorder (PTSD), acute stress disorder (ASD), and common comorbid conditions. Students will learn about the range of events associated with trauma, the prevalence, incidence, and developmental impact of trauma-related disorders across the lifespan, the major risk factors for trauma-related dysfunction, cultural factors that impact dysfunction, trauma-focused assessments for identifying trauma-related symptoms, and the major research-supported approaches to treatment and prevention of trauma-related disorders in the aftermath of trauma. Major treatment approaches to be covered include prolonged exposure (PE), trauma-focused cognitive-behavioral therapy (TF-CBT), cognitive processing therapy (CPT), eye-movement desensitization and reprocessing (EMDR), emotion-focused treatment (EFT), stress management techniques, and psychopharmacological interventions. The recognition, prevention, and treatment of compassion fatigue and vicarious traumatization in the clinician will be emphasized.

PSYC 844: Trauma-Focused Approaches to Psychological Intervention II

3 Credits

This course covers issues concerning the diagnosis and treatment of complex trauma-related dysfunction, particularly post-traumatic

stress disorder (PTSD), Dissociative Disorders, and treating special populations issues. Building upon the theoretical knowledge gained in PSYC 843, the emphasis of the course will be on development and application of skills in conducting empirically-supported therapy and assessment for Type I ('single-event') and Type II ('complex') trauma, Dissociative Disorders, and trauma-associated somatic symptoms. Major treatment approaches to be covered will include phase-oriented integrated treatment and relational models; Skills Training in Affective and Interpersonal Regulation (STAIR); Stress-Inoculation Therapy (SIT), Acceptance and Commitment Therapy (ACT); Dialectical-Behavioral Therapy (DBT), Imagery Rehearsal Therapy (IRT), Narrative Exposure Therapy (NET), and couples and family approaches. The course will also address specific treatment considerations based on trauma type as well as ethical issues relevant to clinical work with trauma survivors. The course will also address the assessment, diagnosis, and treatment of comorbid conditions (depression, anxiety, substance use, relationship problems) and special populations.

Prerequisite: PSYC 843

PSYC 845: Crisis and Disaster-Related Interventions in Psychology

3 Credits

This course will provide students foundational knowledge about crisis intervention and disaster interventions. Students will learn about empirically supported models and best practices of psychological interventions during disasters, taking into context cultural and trauma-specific contextual information. Students will be trained in basic crisis intervention skills and psychological first aid and practice crisis case handling. Students will learn about how to handle specific crisis situations and how to handle issues of burnout, vicarious traumatization, and compassion fatigue in disaster and crisis situations. By the end of the course, students will be able to describe clinicians' roles and responsibilities as members of an interdisciplinary emergency response team during a local, regional, or national crisis, disaster, or other trauma-causing event and know the skills needed to provide crisis intervention services. Students will also learn how to differentiate between diagnosis and developmentally appropriate reactions during crisis, trauma, and disaster using appropriate assessment and diagnosis. Students will be given the opportunity to practice crisis assessment and intervention, as well as learn how assessment, diagnosis, and treatment may be influenced by crisis, trauma, and disasters.

PSYC 895A: Clinical Practicum

3 Credits

This course will give students their first experience of working with clients in a psychological setting. The course will focus on assisting students with their transition to an applied clinical role while attending to their growth as psychological professionals. There will be a focus on integration of psychological theories of counseling and clinical practice. Further, this course will center on ethical issues in counseling, exploring empirically-validated clinical interventions, understanding crisis intervention models, exploring forms of supervision, understanding self-care, and demonstrating case conceptualization skills. The course is designed to meet standards for Pennsylvania Licensed Practicing Counselor (LPC) licensure. The standards for licensure include completing one hundred (100) hours of practicum time prior to placement in an internship. PSYC 895A represents that initial supervised clinical psychology experience. Students will typically complete this experience as part of the training component at the site for their first clinical internship placement, but prior to beginning the internship. Supervising

faculty will be licensed or license eligible in the Commonwealth of Pennsylvania. The on-site supervisors must meet the criteria for clinical supervision mandated by the Commonwealth of Pennsylvania.

Prerequisite: PSYC 500, PSYC 517, PSYC 518, PSYC 519

PSYC 895B: Clinical Internship

1-6 Credits/Maximum of 18

This course is designed to aid meeting standards for Pennsylvania mental health counselor licensure, specifically the LPC (Licensed Professional Counselor). The standards include completing six hundred (600) hours of internship time after completion of 100 clock hours of practica experiences. PSYC 895B represents the 600 hours of supervised experience following the practica. The internship experience builds on the initial practica experience, and is typically completed over two or three semesters, and thus may represent experience gained at more than one placement to increase the breadth of the student's training. Supervising faculty will be licensed or license eligible in the Commonwealth of Pennsylvania. The on-site supervisors must meet the criteria for clinical supervision mandated by the Commonwealth of Pennsylvania. Professional liability insurance is required.

PREREQUISITE PSYC 500, PSYC 517, PSYC 518, PSYC 519, PSYC 895A

Public Administration - CA (PADM)

PADM 502: Governmental Fiscal Decision Making

3 Credits

Nature, function, and technique of governmental budgeting viewed as mechanism for allocating resources among alternative public uses.

PADM 503: Research Design

1-3 Credits/Maximum of 3

Examination of research methodologies relevant to administration, planning, and public policy.

Cross-Listed

PADM 504: Data Analysis for Policy and Administration

3 Credits

This course is intended to prepare students to conduct independent research in policy analysis, program evaluation, and public management. Students will not only learn statistical methods, but how to use them to evaluate public problems and suggest solutions. The course begins with a review of basic research design practices and how statistical analysis fits into the research process. This will be followed with an overview of probability theory as a foundation for inferential statistics. We will then move through the core components of hypothesis testing - the normal distribution, confidence intervals, p-values, and the central limit theorem. All of this lays the foundation for addressing specific types of statistical techniques that administrators and analysts are likely to either conduct or interpret. These include basic descriptive statistics, contingency tables, comparing means, correlation, linear regression, and logistic regression. We will also cover how to effectively visualize data in tables, graphs, and basic spatial displays of data (i.e., mapping using online software). These skills are particularly important for writing professional and academic research reports in public policy and administration and presenting complex information in a straightforward way that the public

can understand. The emphasis in the course is on how these tools can be used for public sector and academic research, as well as how to solve policy and management problems. It prepares students for more advanced courses in policy analysis and program evaluation.

PADM 505: Human Resources in the Public and Nonprofit Sectors

3 Credits

Concepts and approaches contributing to effective use of human resources in public and non-profit organizations; legal issues and requirements.

PADM 506: Public Information Management and Technology

3 Credits

This course provides a broad exploration of government information management and technology issues and organizational and social impacts of these initiatives in government. Understanding policy and management issues in information technology is critical to improve service qualities and performance since public organizations have heavily utilized information technology applications. This course is designed to demonstrate key concepts, issues, trends, and practices of government use of information management and technology, such as government information technology initiatives, implementation of information technology initiatives, e-democracy, e-business, open government, security and privacy, digital divide, e-performance, and information management systems. This course examines managerial, political, and legal challenges and opportunities while managing information technology in the public sector. This course provides students with an opportunity to enhance knowledge and skills for analyzing, evaluating, and managing major policy and managerial practices in information technology. Students will gain better perspectives of managing information technology issues in public and nonprofit organizations.

PADM 507: Introduction to Public Policy Analysis

3 Credits

Introduction to the analysis of public policy within its organizational and political contexts, including an emphasis on an economic perspective. P ADM 507 Introduction to Public Policy Analysis (3) The course is an introduction to the field of policy analysis that focuses on the process of public policy formulation, implementation, and modification. Basic principles of microeconomics are used to examine public policy-making. Students will review basic economic and microeconomic principles, theories, and models, with an emphasis on justification for government intervention. Students will understand the process of policy analysis, including problem formulation, selection of criteria, comparison of alternatives, political and organizational constraints, and implementation and evaluation. The course will be offered once per year and is projected to enroll about 20 students per section. Course Objectives: a) to understand the economic rationale for government action b) to understand the economic component of policy analysis c) to understand government failure, such as inefficient pork-barrel decision-making and excessive bureaucratic red tape d) to understand better the practice of policy analysis e) to understand the stages of the policy process f) to understand the economic and political context in which policy analysis takes place

PADM 510: Organization Behavior

3 Credits

Examines the concepts of human behavior in formal organizations, systems analysis, conceptual models, and decision processes.

Cross-listed with: HADM 510

PADM 511: Organizational Change and Development

3 Credits

Theory of organizational change and development; case analysis of applications in actual situations. PADM 511 Organization Change and Development (3) This course is designed to lead to the understanding of the process of introducing planned change into complex organizations. Specific course goals include gaining an understanding of organization development (OD) as a specific type of change strategy acquiring knowledge of various OD approaches, learning how to assess organizations to enable effective organization change to be introduced, obtaining an understanding of the phases of the OD process and how to manage planned change efforts in organizations, and developing skills in applying the concepts learned to real-life organizational situations. Students will receive "hands-on" experience in designing and implementing organizational change by completing individual reports on OD and the change project as well as a team project report. Grading will be based on development of consulting skills and knowledge through involvement in class activities (10%), being an effective member of the project team (10%), demonstrating understanding of key OD concepts and processes via individual reports and contributions to project team work (40%), and by producing a high quality project based on evaluation of OD process, the final report, and class presentations (40%). PADM 511 is an elective course for the MPA degree and is offered every third semester.

Prerequisite: H ADM510 or P ADM510

PADM 512: Issues in Human Resources

3 Credits

A survey of major human resource issues such as job stress, burnout, and the many forms of discrimination in organizations. P ADM 512 Issues in Human Resources (3) The course has three specific objectives: (1) to become familiar with the subtleties and complexities (interpersonal, legal/regulatory, and effectiveness) of the major human resource issues which confront the human resource manager in public and nonprofit organizations; (2) to develop a practical strategy for handling and coping with the major human resource issues; and (3) to improve research, analytical, and presentation skills. This course will address the following major human resources issues: appraisal and reward systems; various types and forms of discrimination; sexual harassment; disabilities; alcohol and drug abuse; workplace violence; stress and burnout; workplace ethics; and reforming a human resource system. Student grades are based on a final exam (40%); an issue paper (40%); and class participation (20%). P ADM 512 is an elective course for the MPA degree and is offered in a six-week session during the summer semester.

Prerequisite: P ADM505 or P ADM510 or H ADM510

PADM 515: Labor Management Relations

3 Credits

Labor relations issues; collective bargaining agreement, negotiations, and administration; legal framework of collective bargaining; labor relations in larger social context.

Prerequisite: admission to MBA/MSIS Program

Cross-listed with: MNGMT 515

PADM 516: Strategic Planning

3 Credits

A survey of strategic planning purposes, approaches and methods, and expected outcomes in small and large organizations.

PADM 517: Nonprofit Organizations: History and Evolution

3 Credits

A study of the history, development and current role of nonprofit organizations as a distinguishing feature of American society. PADM 517 Nonprofit Organizations: History and Evolution (3) This course is designed to trace the evolution of nonprofit organizations in the United States from colonial times to the present, focusing on the definition, legal foundations, missions, and accomplishments of these entities. The course will offer a review of various nonprofit sectors including healthcare, education, religion, human services, advocacy and the arts. Course objectives are to: - increase student knowledge and understanding of the history and nature of the broad spectrum of nonprofit organizations; - stimulate critical thinking about the role of nonprofit organizations in addressing public problems; and - examine and understand trends and challenges for nonprofit organizations in a market economy. The course will include a combination of lectures, group discussions, review of readings, and student research. Course requirements involve a primary text, Lester M. Salailoil, *America's Nonprofit Sector, A Primer*, 2nd ed. New York: The Foundation Center, 1999, and secondary readings from such areas as history, law, economics, and public administration, e.g., Gronbjerg, Kirsten A., "The U.S. Nonprofit Human Service Sector: A Creeping Revolution," *Nonprofit and Voluntary Sector Quarterly*, Vol. 30, No. 2, June 2001, pp.279-297. Hammack, David C., "Introduction: Growth, Transformation, and Quiet Revolution in the Nonprofit Sector over Two Centuries," *Nonprofit and Voluntary Sector Quarterly*, Vol. 30, No. 2, June 2001, pp. 157-173. Independent Sector and National Center for Nonprofit Boards, *What you Should Know about Nonprofits*. Najam, Adil, "The Four-C's of Third Sector - Government Relations: Cooperation, Confrontation, Complementarity, and Co-optation," *Nonprofit Management and Leadership*, Vol. 10, No. 4, Spring, 2000, pp. 375-396. Smith, Jr., J. Kellum, "Prologue," in Brown, William G., Thomas L. Nygren, Sarah E. Turner, Elizabeth A. Duffy, *The Charitable Nonprofit: An Analysis of Institutional Dynamics and Characteristics*, Jossey-Bass, San Francisco, 1994. pp. xxxix-xxxvi. Weisbrod, Burton A., *Conclusions and Public Policy Issues: Commercialism and the Road Ahead*, "in Weisbrod, Editor, *To Profit or Not to Profit: The Commercial Transformation of the Nonprofit Sector*, Cambridge University Press, United Kingdom, 1998. Young, Dennis R., "Alternative Models of Government-Nonprofit Sector Relations: Theoretical and International Perspectives," *Nonprofit and Voluntary Sector Quarterly*, Vol. 29, No. 1, March, 2000, pp. 149-172.

PADM 518: Nonprofit Organizations: Management and Leadership

3 Credits

A study of the theoretical and practical issues involved in management and leadership of nonprofit organizations. P ADM 518 Nonprofit Organizations: Management and Leadership (3)This course is designed to study the intellectual foundations and application of leadership and management in nonprofit organizations. The course will explore organizational design, leadership, quality management, and performance measurement as applied in social enterprises. Course objectives are: - to increase student knowledge and understanding of the fundamental concepts of leadership and management in nonprofit organizations - to examine trends and challenges for leading and managing nonprofit organizations; and - to stimulate critical thinking about the application of nonprofit leadership and management concepts in a changing environment. The course will include a combination of lectures, group discussions, review of readings, and student research. Student grades will be determined by classroom participation (10%), weekly reading abstracts (10%), midterm examination (20%), major term paper (30%), and final examination (30%). Course requirements involve a primary text and secondary readings from such areas as business, law, and public administration, as well as major term paper. The course is part of a nonprofit concentration in the public administration program and extends the collection of courses in the nonprofit organization area of public administration. Course is expected to be offered once each year.

PADM 519: Nonprofit Organizations: Resource Development and Management

3 Credits

Process by which nonprofit organizations assure that resources are obtained and used effectively and efficiently toward the achievement of objectives. P ADM 519 Nonprofit Organizations: Resource Development and Management (3) Course Description: This course will examine theory, strategies and practices for securing and managing resources for a nonprofit organization. Students will study a variety of fund-raising and other resource acquisition strategies and will examine mechanisms for prudent management of these resources. Course objectives are to increase student knowledge and understanding of the fundamental concepts of resource development for long-term stability of nonprofit organizations and to stimulate critical thinking about the strategies for financial operations of nonprofit organizations in a changing environment. This course extends the collection of courses in the nonprofit concentration area of public administration and further develops the concentration. The course will include a combination of lectures, group discussions, review of readings, and student research. Course requirements involve a primary text and secondary readings from such areas as business, law, grantsmanship, and public administration. The course will be offered every third semester.

PADM 521: Performance Measurement and Management

3 Credits

This course is designed to enhance students' ability to develop and use performance measurement systems in the public sector. P ADM 521 Performance Measurement and Management (3) This course provides a foundation in performance measurement and management in the public sector. It is designed to enhance the ability of students to develop and use performance measurement systems for purposes of improving the management and performance of government programs; and to enhance their ability to think critically about result-

oriented governance and managing for results. In this course students will become familiar with the general context that surrounds public sector performance management, key elements associated with the development of performance measurement systems, and opportunities and challenges associated with the implementation and use of performance measurement systems. Despite its emphasis on the public sector, many concepts covered in the course are also applicable to nonprofit organizations.

Prerequisite: PADM 800**PADM 522: Government Financial Management**

3 Credits

Theories and techniques of financial planning and control, with emphasis on their application in government and nonprofit agencies. P ADM 522 Government Financial Management (3) The focus of this course is on a laboratory in local government budget and financial analysis, concentrating on the theories and applications which also relate to hospitals, businesses, and nonprofit agencies. Applied methods of budgetary decision-making are employed to formulate and to implement a budget based on actual city data. The course places the student in the role of a member of a budget department staff asked to prepare a budget for presentation, debate, and ultimate acceptance by a deliberative body. The work requires one to acquire knowledge of and apply financial management techniques without losing sight of the basic theories from which the techniques grew. The final course grade consists of materials completed by students throughout the course (75%) and the final examination (25%). P ADM 522 is offered every spring semester as an elective in the government concentration of the MPA program.

Prerequisite: P ADM502**PADM 523: Governmental and Nonprofit Accounting**

3 Credits

Accounting, reporting, and auditing principles and procedures for public sector agencies and nonprofit organizations.

Prerequisite: P ADM502**PADM 532: Urban Government**

3 Credits

Administrative processes and policy problems associated with managing urban communities; political, intergovernmental, fiscal, structural, and analytical concepts in urban government.

PADM 533: Local Planning Law and Administration

3 Credits

Structure and function of local and regional government from perspective of local planning law and its administration. P ADM 533 Planning Law and Administration (3) The course covers structure and function of local and regional government from the perspective of local planning law and its administration. Objectives: To develop students' abilities in (a) understanding state and local policies and laws related to planning and administration, local development, regionalism, and regionalization of services; (b) analytic ability, involving the process of careful, rigorous, and systematic thinking at both abstract (theoretical) and concrete (practical) levels; (c) perception of the studies processes from a theoretically informed point of view, through development and application of concepts,

models and other course materials; and (d) application of models and techniques in course assignments. Evaluation: class participation (10%), portfolio, including literature review essay (60%), project/poster (30%). Frequency of offerings: every two years.

PADM 535: Policy Analysis and Planning

3 Credits

The course will cover the theoretical issues in and basic methods of policy analysis and planning (prospective policy analysis). P ADM 535 Policy Analysis and Planning (3) Policy analysis is a systematic inquiry into the nature of policy problems and public policies. It offers a set of principles and methods that can be used in constructing public policies and evaluating their outcomes. This course covers the theoretical approaches and methods in prospective policy analysis and planning. Emphasis will be on the quantitative/analytical methods, but qualitative methods in individual and group problem solving and planning will also be covered. These methods and techniques will be discussed in their theoretical contexts. The course will be divided into three sections. The first section will provide students with an overview of the nature of public policy problems, history of policy analysis, and the current competing theories. The second section will focus on the problems in and methods of gathering and disseminating policy-analytical information. In the policy-analytical process, information is gathered and disseminated in political and cultural contexts; the characteristics of this process and its contexts will be covered in this section. In the third section of the class, the stages and some of the basic methods of policy analysis will be discussed. The focus will be on problem structuring and forecasting methods, cost-benefit analysis, decision trees, and implementation design.

Prerequisite: P ADM503

PADM 550: Policy and Program Evaluation

3 Credits

The course will cover the theoretical issues in and basic methods of policy and program evaluation (retrospective policy analysis). P ADM 550 Policy and Program Evaluation (3) This course is designed to cover the theoretical issues and perspectives in policy and program evaluation, ethical issues in evaluation, and basic methods of evaluation research. The methods of needs assessment, monitoring social programs, impact assessment, and measuring efficiency will be discussed. Students will learn how to conduct randomized experiments, quasi-experiments, evaluation of full coverage programs, and efficiency measurement in evaluation research. The primary goal of this course is to help students become informed consumers of the products of evaluation research. They will also learn the basic skills of designing and conducting evaluation projects. Class time will be devoted mainly to discussions of theoretical concepts and examples. During the semester, students will be given written assignments. They will also conduct policy or program evaluation studies in the areas of their choice.

Prerequisite: P ADM503

PADM 556: State Government Administration

3 Credits

Study of structures, systems, processes, problems, and issues affecting state government administration; case studies, field observations, and research. P ADM 556 State Government Administration (3) State Government Administration aims to provide students with an introduction to management tools and techniques for administering state

government agencies and programs in the context of intersector and intergovernmental relations within a system of representative democracy. The course deals both with management tools as well as policy and management leadership, focusing especially on the nexus between policy and management. Specific course objectives: to foster understanding of the tools and techniques associated with the administration of state government within the context of the broader governance environment; to develop an understanding of the interaction among politics, policy, and management processes at the state level and the role of state officials within institutions and processes; to develop a working knowledge of appropriate tools, models, and concepts associated with state administration via the completion of applied assignments; and to improve communication, writing, and technical skills. Students will be graded on overall discussion (15%), five written news analyses (15%), management papers (40%), and final exam (30%). P ADM 556 is an elective for the MPA degree and is offered every two years.

PADM 557: Federalism and Intergovernmental Relations

3 Credits

Study of the impact of a federal system of government on the administration of public functions. National-state-local dimensions. P ADM 557 Federalism and Intergovernmental Relations (3) The course aims to develop students' abilities in four broad categories: (1) understanding of intergovernmental relations and management as it relates to past, present, and future trends in American governance and the historical, normative, and institutional context of American public administration; (2) analytic ability, involving the process of careful, rigorous, and systematic thinking at both abstract and concrete levels; (3) perception of public administration from a theoretical informed point of view, through development and application of concepts, models, and other course materials related to intergovernmental topics; and (4) application of specific information and skills, with emphasis on issue identification and problem solving. The course offers the students an opportunity to develop the self-awareness and personal capacities that are vital to becoming a dynamic public administrator. The course will be graded on written and oral seminar participation (20%); research and presentations (40%); and two examinations (40%). P ADM 557 is an elective for the MPA degree and is offered every two years.

PADM 558: Legislative Processes

3 Credits

Legislatures in American government, emphasizing comparative state legislatures: constitutional patterns; organization, administration; interaction with bureaucracy, constituencies, and organized interests. PADM 558 Legislative Processes (3) The course examines development of the modern congress and the general assembly; campaigns and elections; party organization and the leadership; committees and the rules of procedure; the "Republicans take over congress;" congress, the President and the bureaucracy: the congressional campaign; congress, interest groups, and the congressional enterprise; congress, the budget, and domestic policy making; the decline of representative democracy. The Pennsylvania state legislature will receive particular attention. The course is designed to equip students to manage programs within the political environment of public and nonprofit administration. The course is evaluated on two short, written reports (25% each); final exam (40%); class participation and presentations (10%). PADM 558 is offered every third semester as an elective for the MPA degree.

PADM 570: Scope and Methods of Public Administration

3 Credits

Examination of theoretical approaches to public administration and the role of theory in the field. PADM 570 Scope and Methods of Public Administration (3) Course objectives: At the conclusion of the semester, each participant should have gained a solid grasp of the literature of public administration; understand the major issues that have created the boundaries and horizons of the field; understand the importance of systematic research and methods of inquiry to the field of public administration; and have a sense of the likely directions research and practice will take in the future. Evaluation for the course will be: Class participation, 10%; individual reports (briefing papers on required assignments), 30%; final paper in the 25-35-page range, 30%; final examination, 30%. This course is the basic core course in the Ph.D. program and is a prerequisite course for the remaining core Ph.D. courses. It is offered each fall to incoming Ph.D. students, with an enrollment of 5-12 students.

Prerequisite: P ADM500**PADM 571: Seminar in Organizational Theory**

3 Credits

Selected theories of organizations and their applications to the study of public organizations.

Prerequisite: P ADM510 or P ADM570**PADM 572: Research and Theory in Public Budgeting and Finance**

3 Credits

The course is designed to provide students with an understanding of the seminal theories and literature in the various topical areas that define the study of public budgeting and public finance. Students will be able to understand and apply the theories in their own research as well as to understand the strengths and limitations of the theory in the context of the topical area. These areas include principles of public budgeting and public finance; the budget process; budget practices; taxation; non-tax revenues; and debt administration. While emphasis is placed on public budgeting and finance as it relates to the U.S. government at the federal, state, and local levels, international experiences are also studied.

PADM 573: Research and Theory in Public Policy and Governance

3 Credits

This seminar provides an overview of policy analysis, basic stages of the policy process, and key theoretical frameworks associated with the subject. The course also addresses ethics in policy analysis and policy analysis as a profession. The stages of the policy process will be considered in detail, from problem definition to termination. Key theories associated with each will be discussed. Additional concepts to be considered include: policy instruments, policy design, issue networks, policy typologies and the politics associated with each. The institutional context of these stages will be considered. Students will explore the impact of positivism and postpositivism on our understanding of policy. Finally, public policy will be examined in light of a variety of approaches to democratic theory and practice.

Prerequisite: P ADM570 or permission of program**PADM 574: Research and Theory in Public and Nonprofit Management**

3 Credits

This course provides a broad exploration of public and nonprofit management issues to improve students' abilities to analyze the given institutional matrix of modern public management. The informed and skillful practices of public and nonprofit management will improve public values and service delivery in effective and efficient ways. This course is designed to understand the theories, perspectives, and functions of management in the public managers and nonprofit sectors; and to assess management practices, possibilities, and challenges encountered with emerging issues. The topics include traditional approaches of management, new public management, history of management, general management theory, structural issues, institutionalized values of management, managerial functions, strategic management, performance management, accountability and leadership, organizational design and institutional governance, global perspectives of management, challenges for public governance, and frontier of management. Students will gain better perspectives of managing the public and nonprofit sectors and build skills to analyze and evaluate management issues and practices.

Prerequisite: P ADM570**PADM 575: Advanced Research Design**

3 Credits

Experimental, quasi-experimental, survey, aggregate, and other research designs applied to organizational, managerial, and policy analysis research problems.

Prerequisite: P ADM503**PADM 576: Multivariate Statistical Methods**

3 Credits

Multivariate statistical methods, with special emphasis on their use in organizational, managerial, and policy analysis research settings.

Prerequisite: P ADM575**PADM 578: Applied Social Network Analysis**

3 Credits

This course covers foundational concepts and methods of social network analysis (SNA). In particular, it covers the mathematical foundations of SNA, SNA research designs, data collection and management methods for SNA, network visualization methods; analytical methods, and applications of SNA. It provides students with basic knowledge of SNA methods and their applications in public policy and administration, sociology, economics, political science, communication/media studies, cultural studies, criminology, business management, and other related fields. Students will learn about the applications of SNA in published journal papers. They will also apply SNA methods in network text analyses and analyses of social media data.

Prerequisite: PADM 504 or CRIMJ 503**PADM 591: Readings in Public Administration**

3 Credits

Directed readings in selected areas of public administration.

Prerequisite: P ADM570 and permission of program

PADM 594: Research Topics

1-18 Credits/Maximum of 18

Supervised student activities on research projects identified on an individual basis.

Prerequisite: P ADM503

PADM 595: Internship

1-18 Credits/Maximum of 18

Supervised off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

Prerequisite: P ADM503

PADM 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

PADM 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

PADM 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

PADM 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

PADM 800: Foundations of Public Administration

3 Credits

PADM 800 is an overview of the study and practice of public administration and non-profit management. It gives students an overview of the basic concepts and issues in the field, including theories of organization, public policy, public management, decision making, public law, program implementation and evaluation, and ethics, and notes how the field has developed over time. Students develop skills in decision making, and in appreciating the multiple perspectives, values, and ethical challenges of public service. The course shows the interrelationships of organizations, public policies, and management activities within the public sector, including the role of nonprofit organizations in delivering services to the public. Theories from social psychology, economics, political science, jurisprudence, ethics, and organizational studies are covered to illustrate the range of ideas used in governance and management. Contemporary efforts to reform organizations and management activities are assessed, and future directions in which the field is likely to head are considered.

PADM 813: Leadership in Public and Nonprofit Organizations

3 Credits

The course presents historical and contemporary leadership theories and concepts to provide a strategic foundation for public leaders in government and nonprofit organizations. The purpose of the course is to increase our student's capacity to lead and to help develop the skills to analyze and address leadership challenges and opportunities.

PADM 897: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

Public Health Preparedness (PHP)

PHP 510: Public Health Preparedness for Disaster and Terrorist Emergencies II

3 Credits

A public health perspective on the preparation necessary to develop a coordinated response to a disaster or terrorist emergency.

Prerequisite: permission of the instructor

PHP 527: Public Health Evaluation of Disasters and Bioterrorism

3 Credits

Introduces students to the design of exposure assessment and health effect studies applicable to disasters and terrorism.

Prerequisite: permission of the instructor

PHP 594: Research Topics

1-15 Credits/Maximum of 15

Supervised student activities on research projects identified on an individual or small-group basis.

Prerequisite: Completion of at least 15 credits in the program or permission of the instructor.

PHP 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

PHP 597: Special Topics

1-3 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently, several topics may be taught in one year or term.

PHP 810: Non-Medical Obstacles to Public Health Responses

3 Credits

This course will enable students to study obstacles outside of traditional pharmaceutical interventions that have major influences on the success

or failure of public health responses. Despite their importance, these impediments are typically studied retroactively instead of being a major component of pre-planning and execution considerations. This course will use a series of case studies to explore Non-Medical Obstacles (NMOs) including security, logistics, communications, and social/cultural issues. Specific areas of focus will be their impact, policy implications, their past mitigation strategies, and future planning opportunities. These NMOs translate across diseases and countries so when their impacts are better understood and incorporated into the planning of future public health responses, it will be possible to provide more effective and efficient care to populations in need.

PHP 830: Critical Infrastructure Protection of Health Care Delivery Systems

3 Credits

This course will enable students to systematically evaluate the critical infrastructure and related vulnerabilities of a hospital or health care system, and then use the knowledge and skills to develop an emergency response plan to mitigate disruption to health care delivery. The course uses an all-hazard approach which would be appropriate for various natural or terrorist events. The course focuses upon the protection of all healthcare delivery for an individual hospital and for a defined residential population. The content includes a review of critical infrastructures, assessment of vulnerabilities, application to a simulated rural/urban county with multiple hospitals, and development of a feasible response to the incident or terrorism. The course stresses advanced preparation, communication, and frequent evaluation of plans. The course also examines the relationship between the healthcare delivery system and the local, state, and federal emergency response agencies in addition to their particular roles relative to disasters and terrorist emergencies.

Prerequisites: PHP 410

Cross-Listed

PHP 831: Public Health Preparedness and the Emergency Operations Plan

3 Credits

Teaches fundamentals of emergency preparedness exercises (i.e. orientation, tabletop, drill, functional and full scale exercises.

Prerequisite: PHP 530

PHP 832: Fundamentals of Biorisk Management

3 Credits

This course covers the principles, methods, and competencies for developing, improving, and evaluating a biorisk management system.

PHP 897: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject with a professional orientation that may be offered infrequently; several different topics may be taught in one year or semester

Public Health Sciences (PHS)

PHS 500: Research Ethics for Clinical Investigators

1 Credits

This course is designed for graduate students preparing for a career that will include clinical investigations.

PHS 503: Nutritional Epidemiology

3 Credits

This course will provide the foundation for understanding Nutritional Epidemiology with a particular focus on theoretical and practical consideration in the design of studies and analysis of dietary data. The material has a strong methodological emphasis, and students are expected to gain a critical understanding of the design, conduct, analysis and interpretation of nutritional epidemiologic studies. The relationship between diet and health outcomes will be thoroughly discussed.

Prerequisites: PHS 554

Cross-listed with: NUTR 503

PHS 504: Behavioral Health Intervention Strategies

3 Credits

Evaluation of intervention strategies from a biobehavioral health context; theories of change processes in health.

PHS 505: Public Health Program Planning and Evaluation

3 Credits

Foundations in public health program planning and evaluation.

Prerequisite: PHS 504 or BB H 504

PHS 506: Behavioral Health Intervention Strategies II

3 Credits

This course provides instruction on how to design theory-driven public health interventions.

Prerequisite: PHS 504 or BB H 504 ; and PHS 505

PHS 507: Public Health Surveillance

3 Credits

Public health surveillance, through collecting and monitoring public health related data as they appear in the real world, plays an important role to ensure public health. This course provides an overview of the principles and practice of public health surveillance and will include design, data collection, and data analysis of the public health surveillance system in general. The skills that students learn from this course will help them better understand and analyze public health issues. Using existing public health surveillance data such as NHANES, NHIS, BRFSS, and SEER, this course provides hands-on experience with analyzing public health surveillance data.

Prerequisite: PHS 520, PHS 550

PHS 510: Grant Writing for Clinical Research

3 Credits

To become independent researchers, students will need to write many grants for external funding. The primary purpose of this course will be for students to experience the full range of grant writing, from review of funding opportunities with a focus on patient- or population-based samples, to forming the research question, preparing, and submitting the grant. Most students are expected to write an F31 application to various NIH-institutions, but other training grant opportunities may be chosen according to the topic of interest. In addition, strategies to get involved in high dimensional or big data will be emphasized, such as human genome data, EMR data, and MARKETSCAN data.

PHS 511: Methods Used in Translational Research

1 Credits

This course is designed to familiarize clinicians with state-of-the-art laboratory techniques as they apply to translational research studies.

PHS 516: Statistical Genetics

3 Credits

Basic theory and methods for statistical analysis, introduction to bioinformatics, principles and methods of statistical genetics, case-control association studies.

PHS 518: Scientific Communication

3 Credits

Advancements in the fields of science, public health and medicine have always depended on effective means of communication. Likewise, so has the success of any individual scientist whether they are working in academia, government or private sectors. This is especially true today where the means of communication are changing rapidly based upon advances in technology and public health concerns. Despite the importance of communication in the sciences, graduate students have limited opportunity to learn the basic concepts of effective communication for which they can rely on and build upon as they continue with their career. Students will learn the importance of the different means of communication in their professions, and the basic concepts underlying becoming an effective communicator.

PHS 519: Patient Centered Research

3 Credits

A survey course designed to provide foundational information regarding 15 core clinical research topics presented in theory and with application. PHS 519 Patient Centered Research (3) Patient Centered Research, PHS 519, is a three credit course specifically designed for physicians who have completed their medical training and are interested in learning about clinical research. Clinical research training is rarely offered in a typical medical school curriculum but is imperative for training academic physicians to perform high quality investigational research. This course covers the opportunities and the expected skills needed to become an independent clinical investigator. This is a survey course which is designed to provide an overview of clinical research along with an introduction to the methods used to conduct clinical research.

PHS 520: Principles of Biostatistics

3 Credits

Introduction to the application of techniques and interpretation of results that are commonly used to plan, analyze, and report clinical and health services research.

PHS 521: Applied Biostatistics

3 Credits

This course is a continuation of Principles of Biostatistics. It covers multi-variable regression methods for continuous, categorical, and time-to-event outcomes. Topics are multiple linear regression including ANOVA, ANCOVA, interaction and model selection, logistic and conditional logistic regression, logistic regression for ordinal data, and survival analysis including the log-rank test and Cox proportional hazards regression.

PREREQUISITES: PHS 520 or STAT 500

PHS 522: Multivariate Biostatistics

3 Credits

This course focuses on advanced topics in biostatistics involving multivariate responses in biomedical research.

Prerequisite: PHS 520; STAT 500, PHS 521

PHS 523: Multivariate Analysis

3 Credits

This course focuses on the theoretical and applied aspects of multivariate analyses that are relevant to biomedical research.

Prerequisite: STAT 511 , STAT 512 , STAT 513 , and STAT 514

PHS 524: Longitudinal Data Analysis

3 Credits

This course focuses on the theoretical and applied aspects of longitudinal data analyses that are relevant to biomedical research.

Prerequisite: PHS 523

PHS 525: Biostatistics for Lab Scientists

3 Credits

Basic theory and methods for statistical analysis, data presentation and experimental design, with a focus on biomedical applications.

Prerequisite: one semester of college calculus (e.g. MATH 110), experience with spreadsheet software such as Microsoft Excel.

PHS 526: Categorical Data Analysis

3 Credits

This course focuses on statistical theory and methods for analyzing categorical data.

Prerequisite: STAT 511 , STAT 512 , STAT 513 , and STAT 514

PHS 527: Survival Analysis

3 Credits

This course focuses on the analysis of time-to-event data with a focus on biomedical research.

Prerequisite: STAT 511 , STAT 512 , STAT 513 , and STAT 514

PHS 528: Bayesian Methods

3 Credits

Approaches to Bayesian modeling and computation with application to medicine and biomedical research.

Prerequisite: STAT 511 , STAT 512 , STAT 513 , and STAT 514

PHS 529: Biostatistical Computing for Public Health

1 Credits

Provides experience in intermediate and advanced usage of a biostatistical software package for public health data analyses. PHS 529 Biostatistical Computing for Public Health (1) The goal of this course is to provide students with the SAS skills to perform intermediate and advanced biostatistical analyses of public health data and associated data management tasks using the SAS system, so that in other public health and biostatistics courses they may focus on theoretical aspects rather than computing and programming issues. Upon completion, students will be able to use standard statistical software and to apply the fundamental concepts of information technology.

Concurrent: PHS 520

PHS 530: Principles of Health Services Research

2 Credits

A foundation course on the principles of health services research and the methods used to conduct health services research. This course gives students a foundation in the principles and methods of health services research, a multidisciplinary field that addresses health policy, health care delivery, health care financing and costs, and quality and outcomes of care. The student will learn about how health services research projects are designed, conducted, reported in the literature, and used by policymakers, providers, and public health practitioners. The general overview provided in this course is intended to increase students' awareness of health services research and to encourage students to continue to learn more about the field and to consider health services research for their capstone projects.

PHS 531: Perspectives on Women's Health

3 Credits

The Perspectives in Women's Health Seminar uses a seminar format and class discussion to address the public health issues facing women today. The course will start with an overview of women's health as a construct, and will then challenge students to consider how public health programs, health care delivery organizations, and public policy can respond to emerging needs in women's health. The course will examine women's health across the lifecourse, focusing on key issues that affect women domestically and internationally, including health problems that exhibit a gender disparity. The aims of this course include the education of public health leaders in women's health, including the sociocultural

and historical factors contributing to conceptions of women's health in the U.S. and worldwide. Students will understand how public health perspectives on women's health are changing, and key issues that are debated in the context of that change. Students will be able to identify key health problems facing women across the lifespan, and be able to identify key biological, psychosocial, and cultural factors that influence women's health.

PHS 532: Population Health Informatics and Analytics

3 Credits

This course explores the principles of population health informatics and analytics, where learners will have practical experiences using data such as clinical, genomic, financial, publicly available secondary data, and other health-related data for analysis aimed at improving patient care across populations by reducing outcome variations, increasing quality and patient satisfaction, and reducing cost of care.

PHS 534: Public Health Law Research and Practice

3 Credits

Public health law research is the "scientific study of the relation of law and legal practices to population health" (Wagenaar & Burris, 2013, p.4). This course is concerned not with what is legal to include within the jurisdiction of public health law (the objective of health law), but with whether law can empirically be shown to affect the health of a population. This course is for M.P.H., Dr.P.H., Ph.D., and J.D. students who want to develop knowledge and skills in a distinct and trans-disciplinary field that combines both law and scientific methods. This course will be highly interactive and will give students an overview of the general concepts of the field of public health law research, the processes or mechanisms through which a law manages to have measurable effects on people's health, and the various study designs for evaluating public health laws.

PHS 535: Quality of Care Measurement

3 Credits

Emphasizes the concept and measurement issues involved in assessing and improving the quality of health care. Students will become acquainted with definitions of quality of care and with a broad range of measures and methods used in public reporting and outcomes research. The policy dimensions of quality of care measurement and improvement will be discussed. Course content will be useful to those interested in outcomes research or research on quality of care, and to those who will assume responsibility for quality of care measurement and improvement programs in public health and/or health care organizations.

Prerequisite: PHS 520, or STAT 500, and PHS 550 or STAT 507

PHS 536: Health Survey Research Methods

3 Credits

This course provides instruction on how to design health research survey questionnaires and how to conduct survey studies.

Prerequisite: PHS 520 ; PHS 550

PHS 537: Health Policy and Law

3 Credits

This course reviews processes related to health policy formulation, implementation, and advocacy.

Prerequisite: PHS 571 or H P A520

PHS 538: Mixed Methods Research

3 Credits

This course will emphasize the use of qualitative methods to complement quantitative data. The course will review the assumptions and mental models that inform both approaches, and the ways in which qualitative and quantitative goals, questions, methods, analysis strategies, and presentation styles can be integrated. Students will first learn the basics of question-making, interviewing, coding, and analyzing qualitative data through practice and examples in the literature. After this overview of qualitative research, the course will highlight the main five designs of mixed methods in the social, behavioral, and health sciences: (1) explanatory sequential; (2) exploratory sequential; (3) embedded; (4) convergent parallel; and (5) transformative. The class will review current literature and guidelines from the National Institutes of Health as primary resources.

Prerequisite: PHS 520; STAT 500, PHS 550; STAT 507

PHS 539: Qualitative Health Research Methods

3 Credits

The course presents the assumptions, techniques, and practical aspects of conducting qualitative health research. Students will develop a good research question, interviewing techniques and guides, codes and coding dictionaries, and an analysis plan for qualitative research. Students will practice qualitative interviewing skills and coding in a health research-based project. The students will critique qualitative articles and learn what constitutes a rigorous methodological and analytic approach to this type of public health research.

PHS 540: Decision Analysis for Public Health

3 Credits

Decision analysis is a tool that uses an explicit, quantitative structure to describe and analyze complex health care decisions. This course analyzes the principles and practice of decision analysis in the context of public health. Students in this course will learn to evaluate decision analyses in different settings, construct simple decision trees, understand the basic mechanics of tree evaluation and sensitivity analysis, and acquire skill in the interpretation and evaluation of a published decision analysis. Extension of basic techniques, such as screening, cost-effectiveness analysis, and the assessment of patient preferences will be covered. We will also cover advanced sensitivity analysis, including probabilistic sensitivity analysis, cost-effectiveness acceptability, and Markov models for chronic diseases.

PHS 541: Decision Analysis II

1 Credits

This course provides an introduction to the methods and applications of decision analysis in clinical decision making.

Prerequisite: enrollment in the Master of Science in Public Health Sciences program and satisfactory completion of PHS 540

PHS 542: Environmental Health Sciences

3 Credits

Overview of the impact that chemical, physical, and biologic agents in the environment have on human health.

PHS 550: Principles of Epidemiology

3 Credits

Students will learn to utilize basic epidemiological methods, i.e., design, calculate, analyze, interpret, report, in the examination of public health problems or programs. Topics include measurements, surveillance, outbreak investigation, bias, and study design.

CONCURRENT: PHS 520; STAT 500

PHS 551: Advanced Epidemiological Methods

3 Credits

Advanced methodological course providing in-depth discussions on applications of advanced methods to design, execution, data analysis, and epidemiological studies reporting.

Prerequisite: PHS 520 and PHS 550 or PHS 510

PHS 552: Molecular Epidemiology of Chronic Disease

3 Credits

This course provides instruction on molecular epidemiologic study design and methods in the study of chronic disease.

PHS 553: Infectious Disease Epidemiology

3 Credits

Principles of infectious disease epidemiology and the use of epidemiologic methods to address infectious diseases of national and international importance.

Prerequisite: PHS 550

PHS 554: Statistical Methods in Public Health I

3 Credits

Biostatistical methods in the design and analysis of epidemiological (observational) studies. This is a course on biostatistical methods in the design and analysis of epidemiological studies. The course addresses design issues with respect to (1) basic epidemiological (observational) studies, such as case-control, cohort, and cross-sectional studies, and (2) more complex studies, such as nested case-control, case-cohort, and case-crossover designs. Next, the course develops basic statistical inference for risk measures according to the nature of the outcome variables (binary and ordinal, continuous, rate, time-to-event). Confounding and interaction issues are discussed, along with statistical methods for handling them, such as standardization, stratification, and matching. More advanced methods are described based on multiple regression models that are specific to the outcome variables, as well as mediation modeling and propensity scores. Finally, computer-intensive

analyses are considered, such as bootstrapping, permutation tests, and multiple imputation for missing data.

PHS 555: Statistical Methods for Public Health II

3 Credits

The course provides in-depth information regarding the principles behind randomized and controlled clinical trials and then delves into topics that are specific to clinical trials. Study designs determine how the data are analyzed and how to avoid/minimize clinical biases, so study designs are investigated: (a) Phase I-IV trials, (b) non-inferiority designs, (c) factorial designs, and (d) crossover designs. Next, sample size calculations are investigated to optimize precision, and the biostatistical and logistical aspects of randomization methods are described. Adaptive designs provide more efficient approaches, especially two-stage approaches. Adaptive designs are investigated for Phase II-III clinical trials. Many clinical trials invoke time-to-event outcomes, so survival analysis methods are covered in detail. Systematic reviews and meta-analyses consist of summarizing and analyzing the data across a set of independent clinical trials. In particular, fixed-effects and random-effects models for meta-analyses are explored. The final topic is medical diagnostic testing, in which clinical researchers try to identify new testing procedures for distinguishing between healthy and diseased individuals.

Prerequisite: PHS 554

PHS 556: Cancer Epidemiology

3 Credits

Cancer is the second leading cause of death in the U.S. Therefore, public health professionals need to know the basic principles and methods of cancer epidemiology. This course will provide a foundation in basic cancer biology, the frequency of disease for the most common cancers, study design, data analysis, and the interpretation of data for cancer epidemiologic studies. The goal is to provide students with the knowledge and skills to apply epidemiologic methods to design and conduct cancer studies, to know study limitations due to biases, and to critically evaluate epidemiologic studies.

Prerequisite: PHS 520, PHS 550

PHS 557: Global Impact of Infectious Diseases

3 Credits

This course is designed to provide an understanding of the global and local perspectives of infectious disease. This course will provide a fundamental knowledge of several different infections including virus, bacterial, and parasitic types. The course will then expand on this knowledge and discuss the impact of these infectious diseases on the global community, then discuss, analyze, and design methods for prevention and control. Diseases of global importance will include: malaria, HIV, hepatitis, dengue, emerging viral hemorrhagic fevers, causes of diarrheal illness, tuberculosis, polio, smallpox, cholera, syphilis, select parasitic diseases, and other diseases as necessitated by current global disease trends.

PHS 558: Cardiovascular Disease Epidemiology

3 Credits

Cardiovascular disease (CVD) is the leading cause of death in the U.S. Therefore, understanding the public health burden of CVD and the basic concepts and principles of CVD epidemiology is important

for public health professionals and CVD researchers. This course will provide a foundation in CVD epidemiology, with a particular focus on the distribution, time trend, and major risk factors of CVD. This course will use examples from cornerstone population-based CVD epidemiological studies to help students understand the study design, analysis, and interpretation of CVD epidemiological studies. Students will use the Atherosclerosis Risk in Communities (ARIC) study data to perform epidemiological investigations of acute myocardial infarction and stroke and their behavioral/lifestyle and demographic determinants (in the first half of the semester) and the biological determinants (in the second half of the semester). The overall goal is to provide students with the knowledge and skills to apply epidemiological methods to design and conduct their own CVD epidemiological studies.

RECOMMENDED PREPARATION: 6-9 credits in epidemiology at the graduate level

PHS 560: Epidemiological Research Methods

3 Credits

The course will provide a foundation in the application of special methods in epidemiological research. The methodology course will cover four major topics: (1) distinct observational study designs; (2) effect modification and interpretation; (3) the applications of propensity score; and (4) causal inference using mediation analysis.

PHS 562: Environmental Epidemiology

3 Credits

This course provides students with an understanding of the major topics in environmental epidemiology and involves the application of epidemiologic methods to environmental exposures. Environmental exposures discussed include environmental tobacco smoke, radon, ambient air pollution, and others. The course material covers 1) the statistical methods and software coding needed to analyze these data, as well as the interpretation of the results of these methods; and 2) geographic information system (GIS) software and coding needed to display epidemiologic data. Spatial statistical methods in environmental epidemiology will be discussed, including geostatistical exposure modeling and areal and point-process data analysis. Also, linear mixed effect (LME) models, generalized additive models (GAMs) and generalized additive mixed models (GAMMs) and their use in environmental epidemiology will be discussed.

PHS 563: Infectious Disease Epidemiology II

3 Credits

The course is designed to help students gain expertise in modern infectious disease research and apply epidemiological methods to address infectious diseases of national and international importance. Emphasis is given to methods of infectious disease dynamics, designs and evaluation of infectious disease surveillance systems, mathematical models in infectious disease epidemiology, and epidemiological methods for infectious disease research. Specific infectious diseases to be covered include HIV/STD, vaccine-preventable diseases and vaccine safety, healthcare-associated infections, global antimicrobial resistance, infection-associated cancers, and emerging infectious disease.

Prerequisite: PHS 550, PHS 553

PHS 565: Statistical Models for Tobacco Research

1 Credits

Provide statistical analytical methods in estimating potential or empirical effects of regulation of tobacco. This course will provide statistical analytical methods in estimating potential or empirical effects of regulation of tobacco (i.e., cigarette consumption, nicotine addiction, pathology, health states). This course will cover skills and tools to construct models for comparing effects under various model assumptions, and project health benefits or harms. This course will also discuss statistical methods of modeling smoking and nicotine dependence and developing cost effectiveness models varying tobacco use and nicotine dependence outcomes. Moreover this course will present models of carcinogenesis based on exposures to tobacco. The primary goal of this course is to enable students to gain an understanding of the potential or anticipated processes and effects by which tobacco regulation may be most effective and least effective in producing public health benefit.

PHS 570: Health Economics and Economic Evaluation

3 Credits

An introductory course on applied economic evaluation, with emphasis on micro-economic theory, cost-effectiveness and economic modeling.

Prerequisite: enrollment in PHS graduate program or discretion of the instructor

PHS 571: Health Services Organization and Delivery

3 Credits

Examination of health systems, organization, financing, and evaluation; trends, problems, and issues.

PHS 574: Methods in Clinical and Public Health Intervention Design

3 Credits

This course provides students with evidence-based guidelines for designing, adapting, implementing, and evaluating public health programs, clinical research studies, and public health policy. The course will expose students to best practices for developing programs and interventions, challenges faced in research and evaluation, and novel methodological approaches for engaging communities and populations. Classes will be divided into three sections, didactic instruction, case study critique, and interactive discussions with researchers. Didactic instruction will cover pertinent topics such as challenges faced when developing public health programs and interventions, conducting a needs assessment, research evaluation, working with under-served and vulnerable communities, and public health policy. During the case study critique the instructor or the students (individually or in dyads) will lead the class in a critical review and discussion of case studies related to the topics discussed in class. The research talk and discussion section of the course will consist of presentations and discussions led by academic researchers and individuals working in the private and public sector. Each speaker will describe a research program, project, or evaluation they led or are currently leading. The speaker will describe for the students the population or health topic of interest explored through the program or study, the analytical methods used, the duration of the study, and study challenges and successes. Students will be asked to consider the

methods used by each speaker and determine if their approach would be applicable to and effective for their population of interest.

PHS 575: Integrative Seminar in Public Health Leadership

3 Credits

Provides the knowledge and skills necessary to understand the dynamic nature of leadership within the public health sector.

PHS 576: Integrative Seminar in Public Health Policy

3 Credits

Provides in-depth exploration of the development, implementation, and analysis of public health and health-related policy.

PHS 577: Integrative Seminar in Social & Behavioral Determinants of Health

3 Credits

Students examine the multiple determinants of population health and initiatives that could improve population health and reduce health disparities.

PHS 578: Advanced Integrative Public Health Leadership

3 Credits

Provides the advanced knowledge and skills necessary to extend the understanding of leadership within public health venues. Advanced Integrative Public Health Leadership will extend the discipline and practice of leadership to prepare students for leading public health initiatives for diverse populations. The advanced concepts covered in this course bridge the foundational concepts learned in previous Dr.P.H. courses to these specialized areas of Leadership constructs. Students will learn advanced leadership theories such as transactional, transformational, servant, and authentic leadership, and how to apply these academic theories to the field of public health leadership, while being aware and culturally understanding of advanced ethical and moral issues, and be able to work effectively with people who have different cognitive styles for problem solving. This course will expose students to the importance of both having and being a mentor and sponsor for professional and personal growth within the public health discipline. Current and relevant social justice themes will be represented through case studies and media reports giving students the opportunities to face and make challenging decisions. This course will have a research and public speaking component to offer students experiential learning within the context of real world problems impacting the health of various populations.

Prerequisite: PHS 575

PHS 580: Clinical Trials: Design and Analysis

3 Credits

This is a foundational course applying biostatistical principles to the design and conduct of randomized and controlled clinical trials; such as estimation of sample size requirements, analytic methods, ethical considerations, and reporting.

Prerequisites: PHS 520, PHS 521

PHS 582: Biostatistical Methods in Clinical Trials

3 Credits

Recommended Preparations: Ph.D. Biostatistics candidates must have completed a Master's degree that includes at least four graduate level Statistics courses. Dr.P.H. candidates must have completed a graduate (e.g., master's) or advanced professional (e.g., MD) degree. Dr.P.H. candidates may also be required to successfully complete PHS 520, a core Biostatistics course, in their first semester. The background knowledge of these candidates provides sufficient preparation for PHS 582. An in-depth course on biostatistical methods in the design and analysis of randomized and controlled clinical trials. PHS 582 Biostatistical Methods in Clinical Trials (3) This is an in-depth course on biostatistical methods in the design and analysis of randomized and controlled clinical trials. The course provides foundational information regarding the principles behind randomized and controlled clinical trials and then delves into topics that are specific to clinical trials. Study designs determine how the data are analyzed and how to avoid/minimize clinical biases, so study designs are investigated: (a) Phase I-IV trials, (b) non-inferiority designs, (c) factorial designs, and (d) crossover designs. Next, sample size calculations are investigated to optimize precision, and the biostatistical and logistical aspects of randomization methods are described. Adaptive designs can provide more efficient approaches, especially two-stage approaches. Adaptive designs are investigated for Phase II-III clinical trials. Many clinical trials invoke time-to-event outcomes, so survival analysis methods are covered in detail. Systematic reviews and meta-analyses consist of summarizing and analyzing the data across a set of independent clinical trials. In particular, fixed-effects and random-effects models for meta-analyses are explored. The final topic is medical diagnostic testing, in which clinical researchers try to identify new testing procedures for distinguishing between healthy and diseased individuals.

Prerequisite: STAT 512 and STAT 514

PHS 583: Asymptotic Tools

3 Credits

An advanced theoretical course on statistical large sample theory and its application in biomedical and public health research. This is an advanced theoretical course on statistical large sample theory and its application in biomedical and public health research. Students are expected to understand the theorems and proofs on large sample theory, and conduct statistical derivation and asymptotic inference by applying the knowledge from the course. Important asymptotic statistics ideas on basic probability theory, statistical large sample theory, and efficient estimation and testing are covered in this course. Specific topics include the modes of convergence, the law of large numbers, Taylor's theorem and delta method, order statistics, central limit theorem, U-statistics, likelihood inference, M-estimates, L-estimates, efficiency of test, goodness of fit, Bootstrap and Jackknife estimates, and permutation and rank tests. In addition, statistical computing is vital for understanding asymptotic theory so program techniques based on R/SAS software are learned and utilized during the course. Students are expected to have taken at least two graduate level courses in mathematical statistics.

PHS 590: Colloquium

1 Credits/Maximum of 3

Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

PHS 594: Research Topics

1-9 Credits/Maximum of 9

A closely monitored, clinical or population based research project that is conducted during the second year of the PHS MS curriculum.

PHS 595: Public Health Practice Internship

1-6 Credits/Maximum of 6

This course provides Master of Public Health degree students with hands-on, "real-world" experience in the practice of public health.

PHS 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects including non-thesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

PHS 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given infrequently to explore, in depth, a comparatively narrow subject that may be of topical or of special interest.

PHS 600: Thesis Research

1-9 Credits/Maximum of 9

Research training provided to enable the student to advance his or her knowledge about a selected topic in public health sciences. PHS 600 Thesis Research (1-9 per semester/maximum of 9) Research training to enable the student to advance his/her knowledge about a selected topic in public health sciences.

PHS 801: Data Management

1 Credits

Development and implementation of plans for managing clinical research data, collection and processing data, and ensuring data quality.

PHS 802: Practice of Public Health

2 Credits

Provides knowledge and skills in methods and procedures used for the practice of public health. PHS 802 Practice of Public Health (2) Practice of Public Health will have two major components. The first is the presentation of core public health knowledge and skills (i.e., evidence-based practice, public health infrastructure, sources of public health data, the public health agenda, the profession of public health, funding public health, professional development for the public health professional, and professional communication) related to the practice of public health. This information will be presented to provide a thorough understanding of the public health system and how it functions in order to ensure good public health practice. This first component will be presented via lectures, discussions and course assignments. The second

component of the course will include the examination and analysis of public health methodology and procedures of public health practice. This component of the course will be accomplished via students' analyses and presentations of public health case studies.

Prerequisite: PHS 501

PHS 803: Principles of Global Health

3 Credits

This course provides an overview of the major issues and initiatives in contemporary global health. This course provides an overview of the major issues and initiatives in contemporary global health. Throughout the course we will explore the political, social, economic, cultural, and environmental determinants of health. We will review the role of global health players such as the World Health Organization, UN agencies, and governmental and nongovernmental organizations, as well as how they interact with health systems to improve health. This course will also discuss the major health issues worldwide and key factors associated with health inequalities. The course will take a public health approach, but will also touch upon global health frameworks from other disciplines such as anthropology and sociology.

PHS 804: Integrating Systems Thinking in Global Health

3 Credits

In this course, students will engage in case studies of global health programs and initiatives. A systems thinking framework will be applied to the cases and students will use the framework to anticipate unintended consequences related to international field work and to propose possible solutions. Cases will illustrate the complexity of global health work and the importance and implications related to the interconnectedness and complementary roles of critical public health systems. The cases used in this course will include a spectrum of small to large scale programs and short-term to long-term response efforts. The framework can be applied domestically and the course will consider domestic health issues. Cases will cover the major topics of the public health system, biosocial context, chronic disease, infectious disease, and systems failures.

PHS 805: Public Health Policy Analysis

3 Credits

This course takes a pragmatic approach to public health policy analysis that aims to provide an understanding of how to do policy analysis. The course uses a case study format to investigate both historical cases and contemporary issues, in parallel, to understand the real-life complexity and challenges in health policy analysis. Attention will be given to what theoretical, ethical, and analytic frameworks best inform policy analysis, what research designs and methods to use, and the historical, political, and contextual influences. Health policy issues are often high profile and demand a public response. By examining health policy cases, both retrospectively and prospectively, students will develop a thoughtful conceptualization of the policy process and a systematic approach to construct clear and testable propositions about the health policy topic they are studying. The case study approach will provide lessons on the evolution of policy implementation, successes, and failures, and provide tools to assist students, as future policy-makers, in evaluating and planning current and future health policy

PHS 806: Public Health Ethics

3 Credits

Public Health Ethics will familiarize students with the tenets that apply to health care delivery, experimentation, research, and human behavior as guided by principles developed over time to apply to government oversight of public health. Many of these principles are the results of specific cases or phenomena that have arisen over time and led to social interventions as a result. The course will look at several seminal events and the ethical principles derived from them. In many cases, principles are still being debated and the lines between ethical and unethical behavior still being negotiated. We will examine the differences between morals, ethics, and laws. We will explore the consequences of violating them. As scientific research grows in size and complexity, new principles will be needed. Students will also demonstrate a sound sense of scholarship and research integrity (SARI) by participating in ongoing discussions about Responsible Conduct of Research (RCR). How should these be formulated by concerned and caring individuals? The course will give some answers. Major topics will include moral reasoning, ethical decision-making frameworks, research integrity, and numerous case studies that highlight the interplay between ethics, law, and public health issues past, present, and future. The aims of this course include the education of public health leaders in applying ethical principles to public health issues, and enhancing decision making skills and capabilities that are necessary for creating an ethical approach to public health practice and research.

PHS 807: Public Health Education Methods

3 Credits

Provides the knowledge and skills associated with the methods used to deliver successful public health education programs.

Prerequisite: PHS 505 and either PHS 504 or BB H 504

PHS 808: Population Health Management

3 Credits

This course is designed to provide students with a contextual understanding of the reasons for a renewed focus on population health as a clinical care-delivery model. An overview of the current state of the health of the U.S. population will set the stage for a brief examination of the Affordable Care Act. New care delivery models, such as Accountable Care Organizations, that are promoted in the ACA are discussed. The course provides an overview of the role Centers for Medicare and Medicaid Services (CMS), state governments, and payers play in creating new healthcare financing models that incentivize a shift from episodic to value-based care. Exploration of changes in reimbursements, the importance of quality measures, and implementation of evidence-based guidelines will be presented. With this foundation, the course focus turns to examine the many elements of population health management as a concept of broader public health goals. These elements include patient attribution models and risk identification and stratification into sub-populations, as well as care coordination - a key strategy in meeting the health needs of a population across the continuum of care. The specific intervention strategies of chronic condition management and transitions of care are described. The primary care setting, which is the focal point of population health management, is explored. The transformation of this care provider to a patient-centered medical home is described along with the evolution of interdisciplinary care teams, the use of extenders such as medical assistants, and the shifted emphasis to prevention and

health promotion. The emphasis on the role of the patient in population health, the need for improvements in health literacy, consideration of the social determinants of health, and the need for health education are discussed. An overview of various technology and data analytical tools and processes used to support population health management care delivery models is provided. Discussion of the importance of using data to track, trend, and measure population health interventions will continue in the technology section of the course. The course will conclude with examinations of the multiple challenges and barriers that health care organizations, payers, and patients experience with value-based care and population health care delivery models. Lastly, a look forward at trends in policy and regulations, application of comparative effectiveness research, and the pervasiveness of 'big data' will allow students to explore the future of health care delivery transformation.

PHS 809: Principles of Public Health

3 Credits

This course provides students with a foundation in public health principles and practice. Students will examine public health models and frameworks, determinants of health, indicators of health, and the etiology of disease. Students will learn about public health milestones and innovations, measures of health and well-being, issues surrounding health disparities, ethical issues in public health practice and research, and the role of state and county health departments in disease control and prevention. Students will examine today's priority health concerns using a public health framework.

PHS 863: Applied Tobacco Research

3 Credits

Provides knowledge and skills in methods for tobacco research, and the use of research to inform tobacco regulation and policy. Applied Tobacco Research will have two major components. The first is a seminar series, presenting topics within four substantive content areas in applied tobacco research: 1) Smoking epidemiology research models, 2) Smoking prevention and biobehavioral interventions, 3) Tobacco regulatory policy, ethics, and consumer influence, and 4) Comparative effectiveness research on tobacco and nicotine regulatory strategies. The second component of the course will include the examination and analysis of a topic area of interest to the student, within the domains of tobacco regulatory science and applied tobacco research.

PHS 864: TCORS Tobacco-Related Biomarkers

2 Credits

Provides knowledge and skills associated with using biomarkers in tobacco research and regulation. This course will provide students with the knowledge and skills associated with using biomarkers in tobacco research and regulation. Topics covered include types of tobacco biomarkers, the effect of smoking behaviors on exposure, biomarkers of smoking-related diseases and disorders, the use of biomarkers in clinical research, analysis and interpretation of biomarker data, and the use of biomarkers in regulatory science.

PHS 890: Colloquium

1-3 Credits/Maximum of 3

Continuing, professionally oriented seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

PHS 892: Directed Studies in Public Health

3 Credits

The Directed Studies course is intended to help prepare students for dissertation research and/or culminating manuscript preparation.

PHS 894: Capstone Experience

3 Credits

A culminating experience in which students create and present a scholarly project based on the competencies gained in previous courses.

Prerequisite: PHS 501 ; PHS 520 ; PHS 550 ; and PHS 571 or H P A520

PHS 895A: Master of Public Health Internship

1-6 Credits/Maximum of 9

Provides Master of Public Health (MPH) degree students with hands-on, real-world experience in the practice of public health. Students are required to complete 20 hours of practice-based activities prior to enrollment in this course. These activities can include community-based volunteer opportunities, PSU COM career development training events, PHASE events, or other activities as approved by the Public Health Program.

Recommended Preparations: Students are required to complete 20 hours of practice-based activities prior to enrollment in this course.

PHS 895B: Advanced Field Experience

1-6 Credits/Maximum of 9

This course provides DrPH degree students with advanced hands-on, practical experience in the practice of public health. Students are required to complete 20 hours of practice-based activities prior to enrollment in this course. These activities can include community-based volunteer opportunities, PSU COM career development training events, PHASE events, or other activities as approved by the Public Health Program.

Recommended Preparations: Students are required to complete 20 hours of practice-based activities prior to enrollment in this course.

PHS 895C: MPH Global Health Internship

1-6 Credits/Maximum of 6

Provides Master of Public Health (M.P.H.) students with real-world experience in the practice of public health in international or local settings. The Master of Public Health (M.P.H.) global health internship aims to provide M.P.H. students with hands-on experience in the practice of public health. The internship builds and reinforces public health practice skills by enabling students to apply what they have learned in the classroom to real-world public health problems and settings. As the M.P.H. is a professional degree, an internship in a real-world public health setting is critical to students' academic and professional development, and their ability to become competent in the practice of public health. Students complete their internships at public health agencies, organizations, and/or institutions, and work on substantive projects that contribute to the mission, goals, and objectives of the sites in which they are placed. Students are matched with public health internships based on their respective academic and professional interests and goals. Students may be matched with pre-approved internships, which have been identified by the M.P.H. program

leadership. Students also may seek out internship opportunities on their own. Internships that are not pre-approved must be reviewed and approved by the M.P.H. program leadership before students can begin. At each internship site, students report to an on-site Preceptor. Preceptors are identified by the M.P.H. program leadership and generally are key decision-makers at their respective agencies, organizations, or institutions. Prior to beginning the internship, students will work with the course Director to develop individualized learning objectives. These learning objectives will shape a student's experience at the internship site and the types of projects the student will complete. The learning objectives also will provide students with a measure against which they can evaluate their efforts and the internship sites. Students are required to complete 20 hours of practice-based activities prior to enrollment in this course. These activities can include community-based volunteer opportunities, PSU COM career development training events, PHASE events, or other activities as approved by the Public Health Program.

Recommended Preparations: Students are required to complete 20 hours of practice-based activities prior to enrollment in this course.

PHS 895D: Dr.P.H. Global Advanced Field Experience

1-6 Credits/Maximum of 6

Provides Doctor of Public Health Students (Dr.P.H.) students with real-world experience in the practice of public health in international or local settings. The Doctor of Public Health Students (Dr.P.H.) Global Advanced Field Experience aims to provide Dr.P.H. students with hands-on experience in the practice of public health. The Global Advanced Field Experience builds and reinforces public health practice skills by enabling students to apply what they have learned in the classroom to real-world public health problems and settings. As the Dr.P.H. is a professional degree, gaining experience in a real-world public health setting through the Global Advanced Field Experience is critical to students' academic and professional development, and their ability to become competent in the practice of public health. Students may complete their Global Advanced Field Experience at public health agencies, organizations, and/or institutions, and work on substantive projects that contribute to the mission, goals, and objectives of the sites in which they are placed. Students are matched with sites based on their respective academic and professional interests and goals. Students may be matched with pre-approved sites, which have been identified by the Dr.P.H. program leadership. Students also may seek out Global Advanced Field Experience opportunities on their own. Global Advanced Field Experience sites that are not pre-approved must be reviewed and approved by the Dr.P.H. program leadership before students can begin. At each site, students report to an on-site Preceptor. Preceptors are identified by the Dr.P.H. student and approved by Dr.P.H. program leadership; they generally are key decision-makers at their respective agencies, organizations, or institutions. Prior to beginning the Global Advanced Field Experience, students will work with the course Director to develop individualized learning objectives linked with at least five Dr.P.H. competencies. These learning objectives will shape a student's experience at the internship site and the types of projects the student will complete. The learning objectives also will provide students with a measure against which they can evaluate their efforts and their ability to meet their competencies.

RECOMMENDED PREPARATION: 20 hours of practice-based activities, can include community-based volunteer opportunities, PSU COM career development training events, PHASE events, or other activities as approved by the DrPH Program

PHS 896: Individual Studies

1-9 Credits/Maximum of 9

Creative projects with a professional orientation, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

PHS 896A: Integrative Doctoral Research I

1-9 Credits/Maximum of 9

This course provides Dr.P.H. degree students with opportunities to demonstrate knowledge and skills gained through doctoral research via manuscript development. Integrative Doctoral Research I is the first of two courses required for the integrative culminating experience for doctor of Public Health students delivered on an individualized basis. Dr.P.H. students will be required to develop two major components for their Dr.P.H. integrative experience that are linked conceptually: two publishable-quality manuscripts. With individualized guidance from their doctoral adviser and doctoral committee, students will develop two manuscripts that comprehensively address, generate, and/or interpret and evaluate knowledge applicable to public health practice. Manuscripts are encouraged to be of an applied nature and must demonstrate students' abilities to conduct independent research on a contemporary public health issue. Students will demonstrate the application of advanced public health practice skills and knowledge in the design and execution of a scholarly project, the analysis and interpretation of the findings, and the application of the new knowledge to advance public health practice. This work should contribute to the evidence base of public health practice, be of publishable quality, be linked to the doctoral portfolio contents and demonstrate critical thinking and rigorous analytic strategies.

Prerequisite: PHS 892

PHS 896B: Integrative Doctoral Research II

1-9 Credits/Maximum of 9

Integrative Doctoral Research II is the second of two courses required for the integrative culminating experience for Doctor of Public Health students and is delivered on an individualized basis. Dr.P.H. students will be required to develop a major component for their Dr.P.H. integrative experience that is linked conceptually to two publishable-quality manuscripts - a doctoral portfolio. With individualized guidance from their doctoral adviser and doctoral committee, students will develop a doctoral portfolio that comprehensively addresses, generates, and/or interprets and evaluates knowledge applicable to public health practice. The portfolio will build upon work completed in prior coursework, the advanced field experience, and other related integrated doctoral research. Students will develop a doctoral portfolio throughout their program that will document how their advanced field experience and doctoral research has informed their leadership in advancing and integrating research into public health practice. The contents of the doctoral portfolio will be used to inform the development of the student's doctoral research and ultimately two publishable manuscripts that stem from this research. Components of the portfolio may include, but are not limited to, research (e.g., publications, conference presentations), teaching (academic and non-academic, community-based teaching), and field and other service learning experiences. Portfolios will require reflection on in-class and out-of class experiences and demonstrate students' broad public health

knowledge, specialized knowledge, translation of this knowledge into evidence-based public health practice, and leadership style.

Prerequisite: PHS 892 and PHS 896A

PHS 897: Special Topics

1-9 Credits/Maximum of 9

Formal courses offered infrequently on a comparatively narrow subject that may be topical or of special interest.

Public Policy Analysis (PPOL)

PPOL 503: Statistics for Public Policy I

3 Credits

This course provides a foundation for both evaluating and conducting quantitative analysis of public policy. The first third of the course examines foundational issues of conducting quantitative analysis of public policy. It does so by reviewing the basic elements of the foundations of such analysis, including the logic of scientific analysis, issues of philosophy of science, measurement theory (validity and reliability), and the elements of research design associated with internal and external validity as they apply to designs common in policy analysis. The remaining two-thirds of the course sequentially examines the use of basic statistical techniques in public policy analysis, including descriptive statistics (frequency distributions, measures of central tendency, and measures of dispersion), probability (the normal, binomial, poisson and other probability distributions), inferential statistics (hypothesis testing, estimating population proportions, and testing differences between two groups), and the analysis of nominal and ordinal data (constructing and analyzing simple and control contingency tables). The course provides a foundation for studying more advanced quantitative analysis techniques, such as regression analysis and related techniques. Throughout the course, the several statistical analysis techniques will be examined through their application to typical public policy problems. The goal of the course is to enable students to become familiar with the basic elements of quantitative analysis of public policy, to enable them to evaluate statistical evidence bearing on public policy decisions, and to conduct basic statistical analysis on public policy questions, all of which are essential for professional careers in public policy.

PPOL 506: Statistics for Public Policy II

3 Credits

This course prepares students for both evaluating and conducting quantitative analysis of public policy using regression and regression-like techniques of statistical analysis. It does so by reviewing the logic of simple and multiple regression and the inferences that can be drawn from such analysis about public policy questions. The course then reviews the detection of violations of the assumptions of the regression model (specification error, heteroskedasticity, serial correlation, collinearity, nonlinearity, nonadditivity, and measurement error), their implications for valid inference, and their correction using extensions of basic regression analysis. The course will also examine regression-like techniques for nominal and ordinal dependent variables and their statistical evaluation. Throughout the course, the several regression analysis techniques will be examined through their application to typical public policy problems. The goal of the course is to enable students to become familiar with the elements of quantitative analysis of public policy using regression analysis, to enable them to evaluate such evidence bearing on public

policy decisions, and to conduct regression analysis on public policy questions, all of which are essential for professional careers in public policy.

Prerequisite: PPOL 503

PPOL 528: Demographic Change and Public Policy

3 Credits

This course will examine the interplay between demographic trends and public policies, largely in the United States. Students will be exposed to the two-way relationship between public policy and demographic change, considering both the impact of policies on demographic outcomes as well as the effect of changing demographic structures on public policy development. Demographic trends play an important role in driving public policy change, especially given the extent to which shifts in population composition emphasize different areas of public policy. Similarly, public policies have implications for outcomes related to population structure and composition, including health, life expectancy, marriage, childbearing, migration, aging, disability, and retirement. Inequality across race, ethnicity, nativity, gender, socioeconomic status, and geographic location is a common thread that runs through each of these relationships. The course provides a detailed examination of each process. The course will involve an introduction to demography and public policy and will cover topics including immigration, health policy and life expectancy, family policies, family structure and fertility, migration and immigration policy, race and racism, housing and urban policy, population aging and pensions, social policy and inequality, and climate and environmental policy. Readings will be a mix of scholarly articles and popular press pieces. Class meetings involve significant expectations for student discussion and participation. Students will complete a policy project that engages with a contemporary demographic issue.

Cross-listed with: SOC 528

PPOL 529: Business and Democracy Around the World

3 Credits

How does business shape democracy? One may be tempted to respond to this question by focusing on the money that business steers into political campaigns. Yet this approach elides a broader understanding of the influence of business on democratic self-government. This course will examine the direct participation of business in politics and public governance through private responses to "government failures" in the provision of goods and services. Through this involvement, business reshapes how democracy works, and we will study several mechanisms by which it does this including distributive public policy and reconceiving the citizen as a customer. Our scope is global; both individual countries and international efforts will be examined. Students will gain important analytic skills by employing frameworks from economics, political science and related disciplines, and will develop a richer understanding of the role that business plays in our political life.

PPOL 553: Comparative Racial and Ethnic Politics

3 Credits

Since its founding, the United States has had to balance the American creed of equality for all, on one hand, with racial inequality, on the other hand. Is this challenge something exclusive to the United States? This course will provide students the opportunity to analyze how race and ethnicity are constructed across the globe as well as how race and politics interact across state borders. Students will examine how

race is constructed and racial ideologies are developed in several countries including the U.S., South Africa, France, Australia and Brazil. By the end of the semester, students should be able to fully engage and contribute to broad literatures on the politics and policy of race and racism. They should readily be able to answer questions such as: What role do countries and their institutions play in developing racial ideologies and racial hierarchies? What political purpose do ideologies such as "racial democracy" serve? How might social scientists best compare notions such as U.S.'s "race problem," Latin America's "shade problem" and Europe's "immigrant problem"? What are the perils of cross-border comparisons, and how, if possible, can social scientists account for state differences in their analyses? The major objectives of the course are to: (1) analyze the effects of historical, social, economic, cultural and global forces on the development of racial and ethnic politics in various countries; (2) define and critically analyze concepts relevant to the study of racial and ethnic politics; (3) identify, critique and apply major academic theories and debates regarding issues of race, ethnicity, inequality and reconciliation; (4) build analytical skills so that students will be able to effectively engage and communicate in public and scholarly discourse about race and ethnic politics; (5) improve writing skills, especially as they relate to manuscript and book reviews; (6) become cognizant of the difficulties that scholars must navigate as they approach topics related to the politics, race, ethnicity as well as comparative/cross-state analysis; and (7) develop a series of best practices to address methodological and theoretical challenges to studying race comparatively.

Cross-listed with: AFAM 553, PLSC 553

PPOL 570: Environmental Policy

3 Credits

This course provides an overview of environmental policy, from an economic perspective, with a focus on practical applications of environmental problem solving. In this course, we will characterize environment problems and examine arguments for policy intervention. The course will cover methods including environmental policy evaluation, cost-benefit analysis, and nonmarket valuation. Policy topics covered include, but are not limited to: air, water, climate, sustainability, development, energy, and environmental justice. The class focuses on US environmental policy; however, topics of global environmental policy will be incorporated. By the end of this course, students will be able to: (1) conduct economic analysis of environmental policy issues; (2) discuss the benefits and drawbacks of commonly applied tools for environmental policy analysis and commonly used generic policies for responding to environmental challenges; (3) identify important landmarks in US environmental policy and describe the surrounding institutional conditions; and (4) communicate evidence, translate scientific findings, and argue persuasively in debates about how to respond to pressing environmental challenges

Recommended Preparations: PPOL 503, PPOL 506 PPOL 802

PPOL 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

PPOL 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

PPOL 599: Foreign Studies

1-12 Credits/Maximum of 24

Courses offered in foreign countries by individual or group instruction.

PPOL 603: Foreign Academic Experience

1-12 Credits/Maximum of 12

Foreign study and/or research approved by the graduate program for students enrolled in a foreign university constituting progress toward the degree.

PPOL 801: The Public Policy Process

3 Credits

The policy process refers to the development of public policy over time and the actors, events, and contexts surrounding this development. Trying to understand and explain the policy process requires an understanding of the relationships among an uncountable number of factors in a dynamic system with nested levels of interactions and uncertain inputs and outputs. This course decomposes this complexity by first considering the political conceptualization of public policy problems, the tools by which public policies – laws, regulations, and markets – are expressed, and the formal and informal actors (voters, legislators, executives, courts, bureaucracies, the media, and interest organizations) engaged in the policy process. The course then examines a number of broad models of the policy process as a whole, including the policy streams, institutional, incremental, advocacy coalition, and punctuated equilibrium models. The course also examines these actors and models at several stages of the policy process running from agenda setting, through policy formulation and adoption, to policy evaluation. The goal of the course is to enable students to identify the wide variety of actors in the policy process, understand the institutional contexts they operate in and the tools of policy influence they seek to employ at several distinct stages of the policy process, and critically assess the implications and empirical veracity of a variety of conceptual models of the policy process.

PPOL 802: Economic Analysis for Public Policy

3 Credits

Should the government directly regulate pollution or allow the market to determine levels of effluents? Should government pay farmers to reduce production of oversupplied crops, or is this an unfair government handout? Economists approach such questions using the basic microeconomic tools of their discipline. Understanding and being able to apply those tools is an essential part of the work of public policy analysts. This course, designed for students with little or no prior training in economics, gives students an overview of the tools and logic economists use in analyzing questions like those above, as well as many others. The focus will be on gaining a sound understanding and familiarity with the basic concepts and modes of analysis used in microeconomics so they can be applied to public policy questions. This includes first a basic overview of the behavior of consumers, firms, and

labor markets, and based on this, the concepts of supply and demand, competition, and consumer and producer surplus. Students will learn how these influence the functioning of markets given that they may be imperfect, including problems of imperfect information, irrational behavior, and market failures associated with externalities and public goods. And third, this course will cover how these problems both play out in the demand for government goods and services and government's production decisions, as well as how these problems might be addressed using the tools of microeconomic analysis. Students will leave this course with a better understanding of how an economist approaches many contemporary policy debates and an ability to use microeconomic analysis to assess policy problems.

PPOL 804: Public Sector Organization Theory

3 Credits

Public policies are more often than not designed by public sector organizations and implemented by them. To understand public policy, then, students must understand public sector organizations. Why are they designed as they are? And why do they behave as they do? Several disciplines offer often competing theories to answer these questions. This course will survey these theories to provide students with a foundation for understanding public sector organizations and how they influence public policy. After first discussing the inherent link between public sector organizations and public policy and discussing how public and private sector organizations differ, this survey will examine several theories that address the internal structure of organizations: bureaucratic, structural, human relations, contingency, and new institutional theories. Behavioral decision theory and incremental theory are then examined as the most prominent views on how organizations make decisions. External influences on organizational structure and behavior are then considered in a review of organization ecology, resource dependency, and organization economics theories. The course will then move beyond isolated organizations by addressing social capital and network theory and social movement theory. In reviewing these several theoretical perspectives, special attention will be placed on public sector organizations and the application of insights from the theories to the design and implementation of public policy. The goals of the course include developing an understanding how the different theories offer critical insights for the design and implementation of public policies

PPOL 805: Bureaucracy and the Policy Process

3 Credits

This course examines the role of bureaucracy in the public policy process. Bureaucracies are critical actors in the conceptualization of policy problems, formulating policy solutions, and implementing public policies, whether directly through government or via the market. Public agencies are also the locus of many public policy careers. We will analyze how public agencies and their employees at all levels of government survive and sometimes prosper within an intensely political environment. The course briefly examines the relationship between politics and policy as first developed in public administration as the politics/administration dichotomy, then via the concept of overhead democracy within political science, and finally in contemporary economics and political science via public choice theory and principal agent models. Second, to better understand this transition in approaches to understanding of bureaucracy, the course develops a working model of bureaucratic politics by examining the motivations of relevant actors and their complex political environment(s). And third, this model is employed to examine the enduring problem of political control of the bureaucracy,

with emphasis on evaluating a number of alternative and competing institutional strategies designed to enhance control. This first of these strategies is via hierarchy as expressed via principal-agent analysis. After outlining the logic of agency theory, the course looks closely at the relationship between bureaucracy and political executives, legislators, courts, and non-governmental actors. This strategy of controlling bureaucracy in the policy process is then contrasted with three others: limited government, non-bureaucratic provision of services by quasi-markets, and competitive bureaucracy in which agencies are designed to compete with each other. The goals of the course are to become first broadly familiar with the issue of bureaucratic politics and then how this influences each stage of the policy process. Beyond that, the goals include an appreciation of the nature of the bureaucratic control problem and the various strategies designed to address it.

Prerequisite: PPOL 801

PPOL 807: Managing Public Organizations

3 Credits

Public policies are more often than not designed by public sector organizations and implemented by them. To understand public policy, then, students must understand public sector organizations and the people who work in them, interact with them, or are served by them. All of these influence the substantive manner in which public policy is actually implemented and the quality of that implementation. Further, many public policy analysts move into line management positions as their careers develop. How well public sector organizations are managed, then, has a significant impact on public policy outcomes and policy analyst careers. This course considers a range of management issues operative in the daily work of public sector organizations. After first discussing the inherent link between public sector organizations and public policy and discussing how public and private sector organizations differ in regard to management, this discussion considers several broad characteristics that distinguish organizations. This includes organizational structures and cultures. It then addresses the roles of leadership and strategic planning in defining the management function. And last, the course surveys a broad range of persistent management issues with a bearing on public policy: managing the civil service system, motivating employees, organizational performance, contracts and networks, and citizen involvement. More dynamically, it examines the management of conflict, change and innovation, and the political environment. The goals of the course include developing both an understanding of the internal and external influences on public sector organizations as they implement public policies and an appreciation of the range of distinct management issues that influence policy outcomes.

Prerequisite: PPOL 804

PPOL 808: Public Finance and Budgeting

3 Credits

This course provides an overview of taxation and expenditure choices made by government as essential inputs into the policy process. How big should government be? What is a good source of revenue? What is a good expenditure? The course examines and compares how different theoretical and disciplinary approaches to fiscal analysis -- economics, political science, and public administration -- answer these questions. In addition to examining the question of the overall size and growth of the public sector and the governmental institutions responsible for fiscal choices, public expenditures will be evaluated from the perspectives of public goods theory (market failure and non market failure), rational

budgeting theory and the development of budget proposals, incremental theory, and democratic theory. Revenue choices will be examined through the lens of both normative tax theory on the criteria of adequacy, stability, efficiency, and equity, and positive theories of taxation that address how taxes are actually adopted and altered by governments. An understanding of tax incidence is central to several of these criteria. The course will also examine the balance of government revenues and expenditures by examining the sources, financing, and consequences of government debt and the use of capital budgets. The course will be especially attentive to how policy professionals apply these varied theoretical approaches to answering these questions. The goal of the course is to enable students to become conversant both with the many conceptual languages in which government taxation and budgeting issues are debated and to prepare them for professional positions in which revenue and expenditures are essential instruments in the formulation and implementation of public policy.

Prerequisite: PPOL 802, PPOL 801

PPOL 809: Public Policy Analysis

3 Credits

This course provides students an overview of prospective public policy analysis as a means of informing public policy choice. That is, it examines how analysis techniques can be used to assess whether proposed policy solution are likely to solve policy problems. The scientific logic underlying formal prospective public policy analysis is discussed before turning to identifying policy problems, conceptualizing public policies from economic, organizational, and political perspectives, and identifying public policy alternatives as well as the criteria for assessing their likely policy consequences and political and organizational feasibility. Several formal methods of prospective public policy analysis are discussed, including a family of back-of-the-envelope techniques, forecasting methods, simulation methods, discounting for probability, risk, and time, cost-benefit analysis, and political and organizational analysis addressing feasibility. Such formal analyses are not, of course, the only type of information used in the policy formulation and adoption process. Thus, the limits on the role of formal analysis in the policy process are discussed along with the effective reporting of formal prospective public policy analyses.

Prerequisite: PPOL 503, PPOL 506

PPOL 810: Policy and Program Evaluation

3 Credits

This course provides students an overview of public policy and program evaluation as a scientifically-based means of assessing whether such programs and policies are effective after they have been adopted and implemented. The scientific logic underlying evaluation research is discussed before turning to conceptualizing public policies and programs as testable hypotheses. After then reviewing measurement theory and its application to public policies and programs, the course discusses the inferential validity criteria used to assess a variety of research designs. A major portion of the course will entail an in-depth discussion of several different research designs, including their logic, implementation, strengths, and weaknesses. These will include discussions of pre-experimental, experimental, correlational, interrupted time series, regression discontinuity, comparison group, case study, and nested research designs. Ethical and other practical problems of constructing evaluation research in the field are examined. Finally, the reporting of evaluation research results along with utilization problems associated

with evaluation reports are discussed. The goals of the course include enabling students to both critically interpret evaluation research reports and to design, conduct, and report evaluation studies of public policies and programs.

Prerequisite: PPOL 803, PPOL 806

PPOL 811: Project Design and Methods

3 Credits

The capstone project is the culminating course in the Master of Public Policy (M.P.P.) program, in which students demonstrate their ability to design and execute a significant public policy analysis project in their area of public policy specialization. Successful completion of the project is a final demonstration that students can perform the professional work of public policy analysts. Capstone projects will likely be a prospective analysis of a policy proposal or a retrospective program or policy evaluation. Indeed, students may build on the policy analysis research proposals they developed in earlier courses. Students are strongly encouraged to do one or the other of these two types of projects, although other types of analysis projects may be submitted for approval to the M.P.P. program. This course will take students through the conceptualization, measurement, analysis, and reporting stages of their projects.

Prerequisite: PPOL 809, PPOL 810 CONCURRENTS: PPOL 894

PPOL 894: Capstone Experience

1-18 Credits/Maximum of 18

Supervised, professionally oriented student activities that constitute the culminating experience in the program.

CONCURRENT: PPOL 811

PPOL 895: Public Policy Internship

1-18 Credits/Maximum of 18

Supervised, professionally oriented, off-campus, non group instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

PPOL 897: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject with a professional orientation that may be offered infrequently; several different topics may be taught in one year or semester.

Quality and Manufacturing Management (QMM)

QMM 552: Applied Statistical Process Control and Experimental Design

3 Credits

Concepts and techniques of statistical process control and the design of experiments.

Prerequisite: QMM 851

QMM 561: Manufacturing Systems Planning and Control I

3 Credits

Systems, components and configurations, flow of material and information in a manufacturing system.

Prerequisite: admission to the QMM program

QMM 562: Manufacturing Systems Planning and Control II

3 Credits

Flow of material and information in a manufacturing system; emphasis on systems integration.

Prerequisite: QMM 561

QMM 581: Manufacturing Processes of Materials

3 Credits

Characteristics of materials with respect to their properties and associated choices of processing to create a range of products.

Prerequisite: admission to the QMM program

QMM 582: Manufacturing and Supply Chain Strategy

3 Credits

Strategic decision context of manufacturing and its supply chains with linkage to corporate and business strategy.

Prerequisite: enrollment in the QMM program

QMM 593: Field Experience in Manufacturing

1-2 Credits/Maximum of 2

Experiential learning through the firsthand study of manufacturing plants and by interacting with manufacturing leaders.

Prerequisite: admission to the Quality and Manufacturing Management (QMM) Program

QMM 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

QMM 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

QMM 851: Quality Management

3 Credits

Concepts of design, assessment, and improvement of quality systems; customer needs analysis, identification of opportunities for application of measurement techniques.

Prerequisite: admission to the QMM program

QMM 871: Design Practice for Manufacturing I

3 Credits

Contemporary concepts in design and design practice with emphasis on engineering, business, and human strategic issues.

Prerequisite: or concurrent: QMM 491 or QMM 492

QMM 872: Design Practice for Manufacturing II

3 Credits

Contemporary concepts in design and design practice with emphasis on logistics, risk, design and manufacturing readiness, and production.

Prerequisite: QMM 871

QMM 891: Communication and Leadership Skills for Manufacturing Managers

1-3 Credits/Maximum of 3

Applied principles of managerial, visual, and written communication that support the needs of manufacturing leaders.

Prerequisite: admission to the QMM Program

Real Estate (REST)

REST 550: Contemporary Issues in Real Estate Markets

2 Credits

This course surveys important issues in real estate markets, including special characteristics of real estate markets, valuation of real properties, mortgage mechanics and calculations, valuing investment opportunities, financing corporate real estate, financing project development, and the secondary mortgage market. After taking this course, students will be able to: 1. Demonstrate understanding of basic features of real estate markets; 2. Value real estate using the sales comparison approach and the income approach; 3. Conduct mortgage-related calculations and make mortgage-financing decisions; 4. Calculate before and after tax cash flows from income properties; 5. Make investment decisions for income properties, and conduct sensitivity analysis; 6. Conduct sensitivity analysis, partition Internal Rate of Return (IRR), and apply the real option approach in making investment decisions; 7. Make real-estate-related decisions for non-real estate firms; 8. Demonstrate understanding of the financing of project development; 9. Know cash-flow mechanics and risk-sharing attributes of some mortgage-backed securities, 10. Demonstrate understanding of Real Estate Investment Trusts (REITs) and their role in real estate investment

REST 560: Real Estate Financial Analysis

2 Credits

This course provides a modern framework for the valuation and analysis of real property using both theoretical and empirical approaches.

Prerequisite: B A 531

REST 570: Institutional Real Estate Investment

2 Credits

This course covers the convergence of real estate and the capital markets. It is designed to expose students to the structure, analysis, and valuation of a variety of real estate securities including: residential mortgage backed securities (MBS), collateralized mortgage obligations (CMOs), commercial mortgage backed securities (CMBS), and real estate investment trusts (REITs). The course also focuses on the role of real estate as a specific asset class in modern portfolio theory. After successfully completing this course, students will have a practical foundation for applying rigorous empirical methods in research to topics related to project level valuation and investment, the role of debt (capital structure), analysis of mortgages, private and public equity investment in real estate, and the role of real estate in portfolio allocation models.

Prerequisite: REST 830; BA 831**REST 575: Quantitative Analysis for Real Estate**

3 Credits

The course provides students with working knowledge of some of the widely used quantitative methods and their applications in business, as well as using statistical analysis software to apply such methods for business analyses and decision-making. By the end of the course, students will understand the purposes of these methods and how to use them to solve real estate, financial, marketing, and risk management problems. - Students will be able to interpret results in ways that are correct, insightful, and useful. - Students will be aware of potential problems of each method and know how to make corrections if these problems are present. - Students will also have developed working knowledge of statistical analysis software widely used by quantitative analysts.

Prerequisite: STAT 500**REST 590: Colloquium**

1-3 Credits/Maximum of 3

Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

REST 594: Research Topics

1-18 Credits

Supervised student activities on research projects identified on an individual or small-group basis.

REST 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

REST 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

REST 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

REST 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

REST 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 3

No description.

REST 830: Real Estate Institutions and Markets Analysis

1 Credits

This course has three objectives: a) provide an overview of modern real estate analysis, b) overview of risk management, and c) develop a series of analytical techniques associated with real estate risk analysis. The course begins with an overview of issues in real estate and risk management. Focus then shifts to a series of legal issues, including property rights and regulations. The remainder of the course deals with the economic and financial evaluation of real estate.

REST 832: Real Estate Negotiations

2 Credits

This course covers principles, strategies and techniques on negotiation with multiple parties involved in commercial real estate transactions, along with fully understanding how to create financially viable agreements. The goal of the course is to give students the opportunity to learn and develop a win-win negotiation strategy, establish smart investment decisions, and implementing negotiations through real world scenarios to create smart investment decisions.

REST 840: Real Estate Analysis Software and Tools

1 Credits

This course will provide a comprehensive overview of the leading real estate industry software used for financial and investment analysis. These software programs provide a platform for investment and valuation analysis of individual properties as well as portfolios. Students successfully completing this course will be prepared to sit for various industry certification exams. After successfully completing this course, students will be able to: - Accurately implement a discounted cash flow model - Perform real estate portfolio analysis - Perform real estate valuation analysis and conduct sensitivity analysis - Demonstrate understanding of the basic inputs to cash flow models. - Create standard industry investment and valuation reports - Conduct market analysis.

REST 880: Real Estate Development and Analysis

2 Credits

This course exposes students to the real estate development process, emphasizing property analysis and deal execution, as well as marketing, management, zoning, and financing. Course lectures will include a variety of speakers that will cover various aspects of the development process. Material covered in their presentations will be critical to successful

completion of the semester research project. The course will include discussions and presentations of development types including, but not limited to Office, Retail, Hotel, Residential, and Warehouse/industrial. Students will work in groups on a semester project to select a site, conduct research, and prepare an appropriate development plan. The project development plan will include a market analysis, project design (including construction costs and preliminary design), and a cash flow pro forma (including financing) to demonstrate the projects feasibility.

Prerequisite: REST 560

REST 885: Real Estate and Business Valuation

3 Credits

This course covers economic theories of valuation applied to real estate as a guide to business decisions. The goal of the course is to give students an understanding of real estate value, how to measure it, and its application to the real estate marketplace.

REST 890: Colloquium

1-3 Credits/Maximum of 3

Continuing, professionally oriented seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

REST 894: Capstone Experience

1 Credits

Enrollment in the course requires concurrent enrollment in REST 880 and matriculation in the Master of Real Estate degree program. During the course, students will analyze an existing or proposed development project. In development teams, students will conduct a thorough analysis on the strengths and weaknesses of the project while considering other factors, such as financial viability, market demand, political requirements, social needs, and physical and environmental constraints. In addition, students may visit existing real estate projects and meet with principal participants in order to conduct an analysis and critique of the strength and weaknesses of the project and apply that knowledge to their final development analysis.

Prerequisites: REST 890 Concurrents: REST 880

Recreation, Park, and Tourism Management (RPTM)

RPTM 501: Leisure Studies Foundations

3 Credits

This course provides general background knowledge about the literature and research methods central to the field of leisure studies.

RPTM 510: Tourism Behavior: An interdisciplinary Approach

3 Credits

An exploration of the various approaches that have been taken in the social sciences to understand tourism behavior.

Prerequisite: 3 credits in statistics; 3 credits in behavioral science

RPTM 525: Behavioral Patterns of the Outdoor Recreationist

3 Credits

Patterns of time and space use; user characteristics; meaning of participation; facilitation of environment-use enhancement.

RPTM 527: Social Psychology of Leisure

3 Credits

Application of the methods, constructs, and theory of social psychology to the study of leisure, outdoor recreation, and therapeutic recreation.

Prerequisite: PSYCH420 , SOC 403

RPTM 530: Research Methods in Leisure Studies

3 Credits

Research techniques, including methods, research design, techniques for data collection, as applied to relevant problems in the leisure studies field.

RPTM 533: Leisure Studies, Surveys, and Appraisals

3 Credits

Advanced procedures related to leisure, recreation, and park research.

Prerequisite: RPTM 530 ; 3 credits in statistics

RPTM 535: Collection and Analysis of Qualitative Data

3 Credits

In this course, students will be given an overview of and have the opportunity to apply many techniques employed by qualitative social science researchers. A particular emphasis will be on inductive, fieldwork-based research methods including participant observation and in-depth interviewing. During class meetings students will participate in seminar discussion of assigned reading material and the shared experiences associated with the preparation of course assignments. These assignments will develop methodological experience through activities conducted locally. Across the semester students will also develop a more elaborate funding proposal for research based on qualitative methodologies. The course will be of particular value to students preparing for thesis or dissertation research utilizing qualitative methods. Though qualitative research is often associated with an interpretivist or humanistic research paradigm, participants espousing a scientific/positivist paradigm are also encouraged to enroll, as are students from outside of Recreation, Park, and Tourism Management.

RPTM 537: Scholarly Development in Recreation, Park and Tourism Management

3 Credits

This course, taught from a recreation, park and tourism management perspective, provides an overview of the varied expectations and responsibilities for doctoral graduates at universities/colleges, non-profit organizations, and governmental agencies. Topics include grant/contract proposals, scholarly and professional publications, and the development of professional vitae, narrative, and teaching portfolios.

RPTM 540: Public and Private Recreation Lands and Waters

3 Credits

Public and private roles and interactions, allocation of resources, use policies, open space concepts, private enterprise developments, legal controls.

RPTM 545: Philosophical and Social Bases of Leisure

3 Credits

Philosophical and social bases of leisure; analysis of critical issues of leisure for philosophical and social implications.

RPTM 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

RPTM 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

RPTM 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

RPTM 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

RPTM 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Supervised experience in teaching and orientation to other selected aspects of the profession at The Pennsylvania State University.

RPTM 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

RPTM 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

Religious Studies (RLST)

RLST 530: Ancient Judaism: Special Topics

3 Credits/Maximum of 3

This course offers rotating topics in the study of ancient Judaism. The choice of primary topic in each iteration of the course is made

by the instructor. The course features advanced study of Judaism in a range of historical settings, from its beginnings in biblical Israel to the development of Jewish texts, traditions, and communities in the Hellenistic and Roman periods. By adopting a critical approach, this course offers students an opportunity to conduct and examine research on ancient Judaism in a theoretically informed, cross-disciplinary manner. The course brings methods, material, and insights from Jewish studies to bear on ongoing work in many fields, including history, philosophy, political theory, religious studies, and comparative literature. Course topics may be thematic, revolving around specific themes like diaspora, Jewish identity, Jewish experiences of empire, or questions of gender. They may be organized around specific places or periods, for example: the history of Jerusalem, Jews in Hellenistic Egypt, first-century Palestine, Roman-era Alexandria, or late antique Babylon. They may also include the analysis of Jewish literature or textual traditions within their social, political, religious, and cultural contexts. The aim of the course is to provide students with critical exposure to aspects of ancient Judaism as well as a solid grounding in scholarly research methods.

Cross-listed with: CAMS 530, JST 530

RLST 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

Research Integrity and Scholarly Ethics (RISE)

RISE 500L: Responsible Conduct of Research in Life and Health Sciences

1 Credits/Maximum of 2

Responsible conduct of research (RCR) is the foundation upon which science depends for rapid progress and appropriate allocation of credit for research accomplishments. In the life and health sciences there have been dramatic changes in the research environment over time that have led to high-stakes professional outcomes for research scientists: multi-million dollar research grants, high-visibility international awards, institutional prestige. Personal accomplishments are intricately tied up with these professional outcomes: career consequences (tenure, expanded research group, etc.), significant personal financial rewards (royalties, start-up companies, etc.), and personal prestige and recognition, among others. These increasing professional and personal pressures on research scientists can have very real impacts on the day-to-day decisions of scientists: appropriate data acquisition and management, proper allocation of credit, responsible use of animals, responsible work with human subjects, appropriate advising and mentoring of students, respect of intellectual property, and the avoidance of conflicts of interest and commitment. This course explores the ethical basis for the responsible conduct of research, and highlights the challenges faced by today's scientists. Students will learn about past failures in the responsible conduct of research that inform the current regulatory environment, understand the current expectations of biomedical scientists beyond the regulations, and, through the use of case studies, explore real ethical dilemmas for which there are not always easy answers. At the conclusion of this course, students will have both intellectual and practical resources to deal with ethical challenges they might face in their careers by making appropriate, ethical decisions.

RISE 597: Special Topics

1 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

Risk Management (RM)

RM 875: Risk Management and Compliance

2-3 Credits

Risk management and compliance (RMC) is a process that organizations can use to limit excessive risk taking and unlawful corporate behavior. This class covers the losses resulting from ineffective risk management and compliance, such as business interruption, class action lawsuits, product recalls, reputational harm, and increased regulation. A variety of risk handling techniques are introduced, with an emphasis on how risk management can increase firm value. Using lectures and cases, the class examines how firms can implement risk management and compliance systems to better monitor and control corporate risk-taking behavior. Throughout the class, the legal, financial, and regulatory incentives to engage in corporate risk-taking are examined across a variety of corporate stakeholders, including managers, senior executives, corporate directors, customers, shareholders, institutional investors, and regulators.

Recommended Preparation: Students should have completed previous coursework in statistics, corporate finance, and microeconomics. However, the material in the class can be easily adjusted to accommodate students without this background.

Rural Sociology (RSOC)

RSOC 502: Use of Theory in Rural Sociology

3 Credits

Examine and evaluate metasociology of alternative theoretical systems applicable to rural society, with emphasis on American society.

Prerequisite: 24 credits in sociology, including 6 in rural sociology and 3 in sociological theory

RSOC 508: Sociology of Agriculture

3 Credits

Sociological analysis of changes in the organization of agriculture and food systems in the United States and developing countries.

RSOC 513: Research Methods in Rural Social Sciences

3 Credits

Scientific method in planning and conducting research.

RSOC 514: Qualitative Research Methods

3 Credits

Learn core approaches for collecting, interpreting and analyzing qualitative data within rural sociology. RSOC 514 Qualitative Research Methods (3) This course provides tools often described as qualitative methods of social inquiry. The course covers basic techniques for

collecting, interpreting and analyzing qualitative data, paying particular attention to their application within rural sociology. Special focus is given to two methods - ethnographic observation and in-depth interviewing. The course operates on two interrelated dimensions, one focused on the theoretical traditions underlying different approaches to qualitative research, the other focused on the practical techniques. These dimensions are linked through reading and critiquing diverse examples of qualitative research, some clearly exemplary, some problematic. The goal is to understand the promise and possible pitfalls of qualitative social research.

RSOC 516: Change in Rural Society

3 Credits

Social change in rural society, emphasizing prediction and control of the change process. Even years. R SOC (CEDEV) 516 Change in Rural Society (3) Rural America has experienced change throughout its history, but the most rapid have occurred in the past three decades. Forces of urbanization, industrialization, technological change and globalization of the economy drive change in rural America, and the effects of these forces differ across the United States. Some rural areas benefit from the changes that occur while others are devastated. Some rural people and places are able to adapt and view change as an opportunity, while others are unable to respond to the forces that threaten them. Individuals, families and communities have changed in response to these broad forces. This becomes manifest in new patterns of inequality, family life, educational attainment, migration, age and racial patterns, health and well-being, and local service availability. Questions examined in this course include: What are the theories that explain or describe the social change that has been affecting rural people and places? What industrial restructuring and economic change has occurred in rural areas, how has it affected rural areas, and what drives this restructuring? What other social change has taken place, and can we determine potential sources of that change? What are the options available to rural people and communities as they adapt to forces of change, and how much can they influence their own futures? Underlying each of these questions is the issue of whether the well-being of rural people, families, and communities has improved or is threatened by these changes, and which rural areas are most likely to benefit and which are threatened. Students will leave the class with a broad understanding of the forces affecting rural America, and how and why those forces influence some people and places differently. Grades are assigned in this class based on a term paper on a topic related to rural social change, reaction papers written about each set of reading assignments, serving as discussion leader, and class participation.

Cross-listed with: CEDEV 516

RSOC 517: International Rural Social Change

3 Credits

Implications of planned change for international rural societies, considering basic structural constraints, known institutional linkages, and potential synergetic consequences. R SOC (CEDEV) 517 International Rural Social Change (3) Three-quarters of the world's population live in developing countries where problems of hunger, malnutrition, underemployment, high morbidity and mortality, overurbanization, and inadequate housing, (to name just a few) often are severe. This seminar covers the sociology of economic change in developing countries. Through an extensive list of readings, a series of topical videos, and in-depth class discussions, seminar participants should come away with a firm grounding in the ways development has been defined, the social and

economic problems facing developing countries today, the basic ways in which economic development has been approached theoretically and empirically, the implications for developing countries of being embedded in a larger world economy, the influence of multinational corporations, the policies that developing countries have followed in fostering economic growth, the nature of foreign aid, the causes and consequences of Third World debt, the nature of the informal economy, rural development and land reform, world hunger and the Green Revolution, and other topics.

Cross-listed with: CEDEV 517

RSOC 522: Data Analysis in Rural Sociology

1 Credits

Analysis of research data in rural sociology using computer library programs.

Prerequisite: or concurrent: AG 400

RSOC 525: Fertility, Population Change, and Development

3 Credits

Fertility and population growth in less-developed countries; theories of fertility change, agricultural development, and population policies.

Prerequisite: SOC 423 or prior work in population

RSOC 530: Sociology and Demography of Poverty in the United States

3 Credits

An in-depth treatment of sociological and demographic dimensions of poverty in rural and urban areas of the United States.

RSOC 552: Theoretical Frameworks for Rural Community Research

3 Credits

Application of community theories to the study of communities in rural areas. R SOC 552 Theoretical Frameworks for Rural Community Research (3) Communities form the fabric of social life in rural areas. It is in these communities that individuals live and work, and experience the broader society and culture. It also is in these communities that individuals deal with the past and make decisions about their own futures. Knowing the theoretical underpinnings of communities in rural areas is crucial for understanding issues of social and economic well-being. This course examines sociological theories of community and how they relate to understanding the organization, structure, interactions and development of rural communities. Rural community theory also plays a role in understanding how community context influences individual and family well-being. In this course, students will gain an appreciation for the role of rural sociology in the study of community. They will read and evaluate theoretical essays and how the theories have been applied in empirical studies of rural communities. The goal is to increase student knowledge and understanding of the research process that links theory and hypothesis development as it relates to the study of community in rural areas. Students will enhance their skills and obtain experience in organizing and leading class discussions; reading, interpreting and integrating theoretical and empirical studies; writing a book review; and writing essays that integrate ideas from assigned materials with student evaluations of the materials. Students will be evaluated on class participation, written essays evaluating key topics, organizing and leading

class discussion, and a written book review. Rural Sociology 452, or its equivalent, is a prerequisite for this class.

Prerequisite: CED 452

RSOC 555: Human Dimensions of Natural Resources

3 Credits

Identification of the interrelationships and influence of human behavior and natural resources.

RSOC 573: Multivariate Statistics for the Social Sciences

3 Credits

This graduate level course focuses on developing, interpreting, and presenting the results from theoretically-informed multivariate regression analyses. The course begins by reviewing basic statistical concepts, descriptive and inferential statistics, ways to handle missing data, bivariate ordinary least squares (OLS) regression, and basic features of statistical software programs. The course proceeds with concepts of multivariate regression, and covers issues such as nonlinearity, outliers, and interaction terms. The final section covers methods for handling complex survey data and estimation techniques for binary, nominal, ordinal, and count outcomes. Students will learn how to choose the best method for the research question; where to locate and how to extract secondary survey data; and how to accurately, clearly, and succinctly describe analytic methods, interpret results, and report findings.

Recommended Preparations: A graduate-level statistics course.

RSOC 575: Ethical Issues in Transdisciplinary Research on Environment and Society

3 Credits

This course foregrounds research in the frontiers of knowledge related to environmental ethics and trans-disciplinary research on the environment and society. It establishes a foundation in key environmental ethics concepts and then helps students develop an interdisciplinary set of ethical, cognitive, reflexive, and professional skills for exploring environmental ethics issues in more detail. As a required course in the TREES dual-title Graduate Program, the course integrates TREES's philosophical and applied approaches to understanding how different value systems in multiple societal contexts influence the management, use, conservation, and preservation of natural resources and the environment. However, the course may also be taken electively by students outside the TREES dual-title program.

Cross-listed with: TREES 575

RSOC 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers

RSOC 594: Research Topics

1-18 Credits/Maximum of 18

Supervised student activities on research projects identified on an individual or small-group basis.

RSOC 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

RSOC 597: **SPECIAL TOPICS**

1-9 Credits/Maximum of 9

RSOC 597G: **SPECIAL TOPICS**

3 Credits

RSOC 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

RSOC 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

RSOC 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Provides advanced standing graduate students from a research oriented curriculum the opportunity to receive experience/supervision in resident instruction in higher education.

RSOC 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

Russian (RUS)

RUS 501: Readings in Russian Literature

3-6 Credits

No description.

Prerequisite: RUS 204

RUS 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

School Psychology (SPSY)

SPSY 500: Professional Issues in School Psychology

1-3 Credits/Maximum of 3

Orientation to the field through study of unique problems, current issues, ethical and legal matters, unique cases, and research projects.

SPSY 503: Development Across the Life Span

3 Credits

This is a graduate level survey course on the scientific discipline of human development across the life span. S PSY 503 Development Across the Life Span (3) The purpose of this course is to give graduate students, especially in the professional practice areas of psychology, such as counseling psychology, school psychology, and clinical psychology and other developed practice areas (e. g., counselor education), an overview of the study of human development across the life span. This survey of the scientific discipline of human development will cover three major areas, with a cultural emphasis: theory, methodology, and research findings. A variety of influential development theories (non exhaustive), in conjunction with classic and contemporary research, will be examined with the goal of providing a framework for comparing and contrasting various theories, concepts, and supporting research as well as understanding their use in the professional practice and research endeavors.

Prerequisite: graduate student status, with priority given to those in the professional practice areas of psychology, such as clinical, counseling, and school psychology, and other developed practice areas (e.g., counselor education)

SPSY 510: Supervision of Pupil Service Personnel

1-10 Credits/Maximum of 10

Program supervision and professional leadership in university clinics and school systems.

Prerequisite: S PSY595A

SPSY 517: Social Aspects of Behavior in Education

3 Credits

A critical and detailed examination of social behavior in canons of classic and contemporary theoretical and empirical work. S PSY 517 Social Aspects of Behavior in Education (3) Social aspects of behavior are fundamental to the practice of professional psychology. This course is designed to provide graduate students in the professional areas of psychology and other developed practice areas a critical and detailed examination of social behavior. Specifically, the course is also designed to illustrate how the individual and social interaction shape and are shaped by the cultures and social situations in which they exist. Students will have the opportunity to acquire and demonstrate substantial understanding of and competence in the current body of knowledge in mainstream social aspects of behavior. Topics that will be addressed are the social cognition, attribution, affiliation, attraction, and social comparison, aggression, equity, and social exchange attitudes and attitude change, conformity, prejudice and discrimination, and group dynamics. Presented within each of these topics will be: (a) the canons of classic research and theory, (b) contemporary theoretical and empirical work, and (c) recent events that show the presence of the social aspects of psychology in daily life. As a result, a focus of each topic will be on the application of social aspects to the practice of psychology and student's own research.

SPSY 530: Psychoeducational Interventions

3 Credits

Development of empirically validated psychoeducational interventions for academic and behavioral problems experienced in school by children and adolescents.

SPSY 535: School-Based Psychological Interventions for Children and Youth

3 Credits

Development of empirically supported psychological and psychoeducational interventions for behavioral and emotional concerns among school-aged children. S PSY 535 School-Based Psychological Interventions for Children and Youth (3) This course is an advanced graduate course that will be offered in the spring semester. Topics will include (a) psychological theories underpinning psychological interventions, (b) introduction to basic individual and group helping and communication skills, (c) criteria for empirically supported psychoeducational interventions, (d) issues related to individual characteristics and medical needs that potentially can impact educational progress, and (e) school-based individual and group crisis intervention skills.

Prerequisite: EDPSY450 , EDPSY475 , PSYCH461

SPSY 540: Academic Instruction and Intervention

3 Credits/Maximum of 999

This course complements the school-based intervention sequence for students enrolled in the School Psychology doctoral program. Academic Instruction and Intervention complements the school-based intervention sequence for students enrolled in the School Psychology doctoral program. This course covers the theoretical and empirical foundation for effective instruction, academic skills assessment, and academic intervention for K-12 students. This course will provide an overview of specific teaching behaviors associated with positive student outcomes and provide a framework for assessing those behaviors. In addition, this course will explore effective academic interventions for students who need support beyond what is typically provided in the classroom environment. Coursework will emphasize theoretical and empirical issues; however, students will also work to apply intervention skills in practice.

Prerequisite: S PSY 500

SPSY 551: Professional Development of School Psychologists in Working with English Language Learners (ELL)

3 Credits

This course is designed to educate school psychology graduate students on accommodations and adaptations for diverse learners, per Pennsylvania's guidelines. S PSY 551 Professional Development of School Psychologists in Working with English Language Learners (ELL) (3) This course is designed to situate information about language and English learners in the context of working school psychologists. The first half of the course will provide foundational information on the history and sociopolitical influence of language, native language development, and second language acquisition through the lens and application of a school psychologist. The second half of the course will carry over the information learned and focus on directly applying it to the best practice

of a school psychologist as a scientist-practitioner by understanding and using sound research outcomes in providing educational services (assessment, intervention, and consultation) to ELL students (K-12) with disabilities or at-risk.

SPSY 554: Psychological and Educational Evaluation of Exceptional Children

3 Credits

Administration and interpretation of individual tests other than the Stanford- Binet, WISC, WAIS.

Prerequisite: S PSY559

SPSY 555: Special Education, School Governance, and School Law

3 Credits/Maximum of 999

Special Education, law, and school governance will provide a framework of how schools operate to help school psychologists effect change. This course will provide a basic framework of how school systems operate in order to help school psychologists and other potential school leaders effect change. Individuals involved in the operation of public schools must be familiar with the laws that govern these educational institutions because legal developments impact schools, educators, and parents. Schools are political systems that affect the working world of educators through the use of power and influence, bargaining, and negotiation. Thus, related topics will include educational leadership, policy and governance, negotiations and personnel management, legal aspects of public schools, business and finance, and school and community relations.

SPSY 556: Psychological Assessment of Preschool and School-Aged Children

3 Credits

Study of cognitive/affective tests; use of systems (analytic, multivariate statistical, actuarial methods of data combination) in decision-making processes. Studies indicate that a major job function of school psychologists is the evaluation and classification of children who are thought to be exceptional. Diagnosis of learning and personal/ social problems of children is complex and highly dependent upon assessment strategies. Although individual-level diagnostic tools are still a hallmark of school psychological practice, up-and-coming professionals also need to be prepared to think through universal screening, progress monitoring, program implementation, and systems-change to support children with social-emotional problems as part of three-tiered service delivery models such as School-Wide Positive Behavior Intervention and Supports, school-based mental health, and Response to Intervention frameworks. Within this overall "blueprint" the course will focus on six critical areas: 1. The evaluation of specific assessment techniques in relation to acceptable psychometric standards to include a review of universal screening, progress monitoring, and individual-level/ targeted techniques (to include lethality risk assessment including risk for harm to self or others). 2. The statistical selection, use, and adaptation of diagnostic batteries. 3. The use and interpretation of computer output in the evaluation of predictive validity, clinical utility, bias, and clustering of both psychological variables and children. 4. Comprehensive case planning for social-emotional assessment in school settings and carrying out mock evaluations that emphasize social-emotional concerns for students. 5. The use of diagnostic reports as vehicles for facilitating instructional and social-emotional goal planning for children. 6. The

reporting of results of screening and diagnostic results to parents and teachers to facilitate shared understanding.

Prerequisite: EDPSY400 , EDPSY450 ; EDPSY554 or S PSY559

SPSY 559: The Individual Psychological Examination

3 Credits

Demonstrations and practice in widely used ability and aptitude tests; psychological report writing.

Prerequisite: 15 credits in psychology and a course in measurement

SPSY 561: Consultation in Educational Settings

3 Credits

Prepares students to consult with teachers, administrators, parents, and other professionals about academic, behavioral, social-emotional, and programmatic issues. S PSY 561 Consultation in Educational Settings (3) This course will be an advanced graduate seminar which will be offered in the fall semester by the School Psychology program. Topics will include: (a) the history of consultation; (b) a review of the major consultation models (mental health, behavioral, instructional, organizational development); (c) research literature on consultation; (d) application of the consultation models in practice; (e) cross-cultural consultation; and (f) ethical and legal issues in consultation. Students completing this course will have a solid grounding in consultation theory and research as well as supervised experiences consulting with educators. Final grades will be based on a number of criteria including classroom participation, analyses of daily readings, a mid-semester examination, a final paper, written logs of consultation activities, regular attendance, and active participation in classroom discussions and activities. Although a mandatory course for advanced graduate students in School Psychology, the course will also be a useful addition to the training of other graduate students who will be consulting with parents or teachers around psycho-educational issues. To benefit from the course, students should have some prior training in assessment and intervention. Prior to working with educational professionals, students will participate in role-plays and simulations to hone their skills. Actual consultation sessions will be videotaped and students will also be expected to critically analyze the videotapes as part of the process of self-improvement and to demonstrate their ability to learn from their own mistakes.

Prerequisite: EDPSY450 , SPLED401

SPSY 575: Child and Adolescent Psychopathology

3 Credits

This course will familiarize students with specific psychiatric disorders of childhood and adolescence encountered by mental health professionals in schools. S PSY 575 Child and Adolescent Psychopathology (3) This course will familiarize students with many of the child and adolescent disorders that mental health professionals encounter in working with preschool and school-age children. The primary focus of the course is to provide students with an historic understanding of the epidemiology, etiology, diagnostic criteria, and long-term implications of specific childhood disorders, with an emphasis on those likely to be encountered by practicing school psychologists. In addition to these topics, class discussion will focus on current controversies and research directions regarding the study of childhood psychopathology as well as ongoing changes to diagnostic systems. Individual class sessions will consist of

discussion, group activities, student presentations, and the observation of actual casework. Students are expected not only to participate in but also to facilitate group discussions. Students will be encouraged to share their experiences working with children and adolescents with psychological disorders. Because childhood psychopathology is a broad domain, discussion topics for the course primarily reflect the disorders most frequently observed in typical school populations. Through individual projects, however, students will have the opportunity to explore areas of child or adolescent psychopathology that may not have been addressed in this course.

SPSY 594: Research Topics

1-3 Credits/Maximum of 6

Graduate seminar examining current research in the field of School Psychology.

Prerequisite: EDPSY475 and EDPSY406 and either EDPSY450 or EDPSY554

SPSY 595: **SPECIAL TOPICS**

1-6 Credits/Maximum of 10

SPSY 595A: Practicum

1-6 Credits/Maximum of 6

Clinical experience with children under supervision in a variety of settings requiring service, including practice in synthesizing data and observations.

Prerequisite: PA Act 34 clearance required. In addition, non-Pennsylvania residents must provide evidence of an FBI background information check. (Forms: 228 Chambers)

SPSY 595B: Internship

1-10 Credits/Maximum of 10

Long-term placement in settings providing work for school psychologists with children, parents, teachers, administrators, and service agencies, under supervision.

Prerequisite: PA Act 34 clearance required. In addition, non-Pennsylvania residents must provide evidence of an FBI background information check. (Forms: 228 Chambers)

SPSY 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

SPSY 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject that may be offered infrequently; several different topics may be taught in one year or semester. A specific title may be used in each instance and will be entered on the student's transcript. Multiple offerings may be accommodated by the use of suffixes, A, B, etc.

SPSY 597A: **SPECIAL TOPICS**

1 Credits

SPSY 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

SPSY 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

SPSY 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Supervised Experience in College Teaching.

SPSY 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

SPSY 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

SPSY 843: Prevention Strategies and Programming

3 Credits

Addresses prevention program development, implementation, and evaluation, along with theoretical and empirical underpinnings, ethical and multicultural issues related to prevention.

Cross-listed with: CNED 843

Science (SC)

SC 595: Internship

1-18 Credits/Maximum of 18

Supervised off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

Full-Time Equivalent Course

Science Education (SCIED)

SCIED 550: Science Education Curriculum

3 Credits

History, analysis, and evaluation of precollege science curricula. SCIED 550 Science Education Curriculum (3) The course examines the precollege science curriculum: its history in the United States, the sociocultural influences that shaped it, the impact of recent state and national science standards documents, the evolution of changing theoretical and practical aspects of curriculum design, and the influence of science education research on curriculum. Participants investigate and apply methods for analyzing and evaluating curricula, and review

research on the impacts of curriculum and instruction on student learning and other outcomes. Broader questions concerning economics, ethnicity, language, gender, and class will inform this work.

SCIED 551: History, Philosophy, & Sociology of Science and Science Teaching

3 Credits

Examination of the implications of history, philosophy, and sociology of science for science teaching. SCIED 551 History, Philosophy, & Sociology of Science and Science Teaching (3) This course explores science and school science studies from a sociocultural perspective. Topics draw from scholarship in the sociology, philosophy, and discourse of science. Among the central topics for discussion will be the social context of disciplinary knowledge, problems of experimentation, ideological bias in research, feminist critiques of science, the discourse of school science, multicultural issues in science, and knowledge access issues. The focus will remain on curriculum, instruction, and learning throughout the course. The course goals include learning about the history, philosophy, and sociology (HPS) of science as related to science education, learning about educational research and scholarship, applying ideas from HPS to the field of science education research. Students are expected to examine and interpret contemporary research in science education and related fields.

Prerequisite: graduate standing

SCIED 552: Science Teaching and Learning

3 Credits

Exploration of the theoretical and empirical foundations of the teaching and learning of science. SCIED 552 Science Teaching and Learning (3) This course is an exploration of the foundational empirical and theoretical research in the teaching and learning of science. The first part of the course includes a core of learning theory based in the literature of education and science education. In addition to this theoretical work students will read empirical studies based on different theoretical foundations allowing for the critical examination of the relationship between theory and empirical based on theory. The readings and discussions in this course will be centered on the questions of "Is there a science of education that allows us to make instructional decisions in science teaching based on research?" and "What is the theoretical basis of standards-based science education reforms such as inquiry-based science?" The goal of this course is to help students develop a core foundational knowledge in the science education literature as well as an articulated theoretical framework for teaching and learning they can use to develop their own research projects.

SCIED 558: Research Problems in Science Teaching

3 Credits

Problems and research dealing with curriculum, materials, evaluation, and supervision of science teaching and learning.

Prerequisite: SCIED412 or SCIED458 ; teaching experience

SCIED 583: Survey of Research in Learning Sciences and Technology

3 Credits

Analysis and evaluation of research in domains of learning sciences and technology. This course reviews the empirical research literature from the Learning Sciences and Technology fields. Students will gain

experiences reading and understanding research papers to understand modern perspectives on the theories, models, methods, and tools used in the learning sciences.

Cross-listed with: LDT 583

SCIED 590: Colloquium

1-3 Credits/Maximum of 3

continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

SCIED 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

SCIED 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

SCIED 855: Precollege Engineering Education

3 Credits

This course is intended to help experienced educators to critically understand the "E" in "STEM education." Engineering has only recently roared into state and national curriculum standards, venturing out of its traditional lair in higher education. We explore the reasons for this development, as well as the opportunities and challenges that the change presents for students and teachers. As we proceed, we draw upon the varied experiences of participants, including teachers from elementary, middle, and secondary schools, as well as informal settings such as science museums. Because few precollege STEM teachers have studied engineering formally, we review the history and nature of engineering, and work through a number of activities that model aspects of engineering work. Throughout the course, an emphasis is placed on the epistemic practices of engineering, which make the subject unique among school subjects. Contemporary relevant school curricula and informal educational programs are reviewed, and students carry out an actual design project. This course is intended for teachers, and prior formal training in design, modeling, and physics is not required.

Science, Technology, and Society (STS)

STS 589: Ethics and Values in Science and Technology

3 Credits

Study interrelationships of 20th century technological change and human values with emphasis on social and ethical aspects of technological progress.

Social and Behavioral Neuroscience (SBN)

SBN 505: Seminar in Social and Behavioral Neuroscience

3 Credits/Maximum of 12

Each section of this course explores an important topical area within contemporary social and behavioral neuroscience, exploring pertinent concepts, theories, and empirical findings. Topics explored may include the neuroscience underpinnings of social, personality, and emotional development; the neuroscience of aging and memory; and social and affective neuroscience. The intention of this course is to lay a foundation so that students may critically read and conduct research in the topical area, with an emphasis on how the topic can be examined at different levels of analysis, and how integrating information across levels of analysis furthers advancement in the field. Levels of analysis include neurochemical and cellular processes, neural networks and systems, behavioral manifestation, and dynamic feedback from the environmental context. The course will emphasize class participation and provide multiple opportunities to examine related topics in written and spoken form

Prerequisite: NEURO 520 or NEURO 521

SBN 508: Methods in Social and Behavioral Neuroscience

3 Credits/Maximum of 12

Different sections of SBN 508 will explore important topical areas in the broader domain of research design, experimental and measurement techniques, and data analytic methods that are common to Social and Behavioral Neuroscience or are newly developed, cutting edge methods in the field. Courses will include an examination of (a) the biological process being measured (e.g. what type of neural activity is and is not captured in fMRI), (b) the foundational principles of the experimental and/or measurement technique, (c) the analytical approaches pertinent to the type of data being generated, and (d) methodological issues of particular relevance to the experimental technique and/or design being used. The intent of SBN 508 is to provide students with a strong foundation in research design, procedures, measurement, and data analytic approaches that students can carry forward and use in research projects in Social and Behavioral Neuroscience. SBN 508 will emphasize class participation and provide multiple opportunities to examine related topics in written and spoken form. Courses will also provide students with the opportunity to work with the relevant data types to provide an immersive experience in design and analysis. We anticipate that SBN 508 course sections will be continually revised and updated to reflect new and innovative experimental, measurement, and data analytical techniques that continually appear in the scientific literature.

Prerequisite: NEURO 520; or NEURO 521

SBN 511: Translational Applications of Social and Behavioral Neuroscience

3 Credits/Maximum of 12

This course explores translational applications of Social and Behavioral Neuroscience to a particular population or populations at risk, how neuroscience contributes to a broader multi-level understanding of the phenomenon and more comprehensive theory and evidence-based intervention approaches, and how understandings derived from

neuroscience can inform policy and best practice. Content may also address how neuroscience can contribute to the evaluation of behavioral interventions to inform factors such as (a) etiological heterogeneity that may moderate treatment efficacy, (b) neurological processes that mediate the behavioral effects of intervention, and (c) the implications of neuroscience evidence for assessing individual-level responsiveness to intervention. These topics naturally integrate advances in the idea of "personalized medicine" to include behaviorally targeted prevention and intervention programs. Topics explored may include the neuroscientific substrates of: substance use, misuse, and addiction, learning disabilities, developmental disability, and behavioral problems. SBN 511 will incorporate transdisciplinary, transactional developmental models that take into account individual characteristics across multiple levels of analysis (i.e. genetic, neurobiological, psychological, behavioral) throughout childhood, adolescence, and adulthood, in interaction with contextual and experiential conditions (family, peers, adversity) that bear directly on individual risk and resilience and, more broadly, policy and best practice. This course aims to lay a foundation so that students may critically read and conduct research in the topical area and understand how the topic can be examined at different levels of analysis. The course will emphasize class participation and provide multiple opportunities to examine related topics in written and spoken form.

Prerequisite: NEURO 520 or NEURO 521

SBN 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

SBN 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

Social Data Analytics (SODA)

SODA 501: Big Social Data: Approaches and Issues

3 Credits

Interdisciplinary integration of computational, informational, statistical, visual analytic, and social scientific approaches to the creation of big social data. This course addresses computational, informational, statistical, visual analytic, and social scientific approaches to the creation of data that are both "social" (about, or arising from, human interactions) and big (of sufficient scale, variety, or complexity to strain the informational, computational, or cognitive limits of conventional social scientific approaches to data collection or analysis). Examples include text, image, audio, video, intensive spatial and/or longitudinal data, data with complex network, hierarchical and/or other relational information, data from distributed sensors and mobile devices, digitized archival data, and data exhaust from sources like social media. Possible topics include sources of social data, data structures and formats for social data, data collection and manipulation technologies, data linkage and alignment, ethics and scientific responsibility in human subjects research, experimental and observational data collection design for causal inference, measurement of latent social concepts, reliability and

validity, search and information retrieval, nonrelational and distributed databases, and standards for data preservation and sharing.

SODA 502: Social Data Analytics: Approaches and Issues

3 Credits

Interdisciplinary integration of computational, informational, statistical, visual analytic, and social scientific approaches to learning from big social data. This course addresses the interdisciplinary integration of computational, informational, statistical, visual analytic, and social scientific approaches to learning from data that are both "social" (about, or arising from, human interactions) and "big" (of sufficient scale, variety, or complexity to strain the informational, computational, or cognitive limits of conventional social scientific approaches to data collection or analysis). Topics include alternative scientific models for learning from data (Bayesian inference, causal inference, statistical / machine learning, visual analytics, measurement modeling), analytics issues with big data (variable selection, parallel computing, algorithmic scaling, ensemble modeling, validation), analytics issues with particular structures and channels of social data (network data, geospatial data, intensive longitudinal data, text data), and issues of scientific responsibility and ethics in analysis of big social data.

Social Studies Education (SSED)

SSED 533: Research on Social Studies Education

3 Credits

This course examines current and influential theory and research on social studies education in the context of K-12 schools and curriculum. The field of social studies education is broad and inclusive of different disciplines and academic content that relate to the social education of learners: histories of countries, peoples, social groups, movements, and the world; historical narratives and counternarratives of identities and heritage; notions of citizenship/civic belonging, civic engagement, and social justice; politics and ideologies; media and technology; sociology and sociocultural analyses; economic development, equity, and socioeconomic analyses; geography and world cultures; globalization and globalism; place and environments; and the interplay of individuals, groups, and institutions. How is social content positioned (or neglected) in school curriculum and educational policy? How is social content taught by teachers and learned by young people? How is that learning assessed and used? What are the implications for how young people learn about the world, cultures, social phenomena, and the past? These are kinds of questions that the social studies education research field explores. This course offers an overview of the research base and significant current scholarship on social studies education. It provides students with a grounding in reading and analyzing that literature, synthesizing ideas from across bodies of research, and applying research findings and interpretations to curricular and educational work. Course activities and assignments give students exposure to critically evaluating this research and scholarship and applying research findings to educational practice, curriculum design, professional development, or future academic inquiry.

RECOMMENDED PREPARATION: Teacher certification and/or teaching experience in K-12 Social Studies or a related subject

SSED 535: Teaching and Learning Historical Literacy with Media

3 Credits

Study of how historically oriented media influence learning about past and connect to present with challenges and potential for education.

SSED 536: Historical Nonfiction for Teaching History

3 Credits

This course is an intensive study of different nonfiction history texts and the historical interpretations they offer for K-12 social studies teaching and curriculum. Through engaging with these texts and their ideas, the student will gain stronger understanding of historical research and scholarship broadly and on particular topics to apply to history education. Works of historical nonfiction include-and often combine features from across-the following different types: - academic historiography (original historical research for specialized audiences) - public scholarship (intellectual writing for informed public audiences) - popular history (texts that don't require extensive prior knowledge for mass audiences) - narrative history (factual storytelling to inform and entertain). Focus is on learning to analyze historical nonfiction for factual evidence, claims, warrants, concepts, and interpretations that can support intellectually rigorous instruction and curriculum design. Course exercises will give the student opportunities to think about age-appropriate adaptation of complex historical content. Students will learn to synthesize conclusions from across texts to form generalizations that address compelling questions for K-12 history education..

SSED 537: Teaching Citizenship for Civic Engagement

3 Credits

This course explores citizenship education for civic engagement. Lessons revolve around three essential questions culled from the research literature: What kind of citizens and civic engagement does a 21st century democracy need? What should these citizens know, believe, and be able to do? What practices, programs, and structures in educational settings promote active citizenship? Activities and written assignments work to answer each of these questions, encouraging students to grapple with competing theories of citizenship that have shaped citizenship education programs in schools and universities. Course exercises will give students opportunities to think about and weigh their commitment to different definitions and theories of democracy, civic engagement, and citizenship. Students will analyze how educators have put those definitions and theories into practice across educational settings. In analyzing how civic engagement can be fostered across the educational lifespan-from the earliest grades to university education-students should take note of commonalities in approach as well as age-appropriate differences.

SSED 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

SSED 897: Special Topics

1-9 Credits/Maximum of 18

Formal courses given on a topical or special interest subject which maybe offered infrequently; several different topics may be taught in one year or semester.

Social Thought (SOCTH)**SOCTH 501: Seminar in Social Thought**

3 Credits

Selected topics in the historical development of the tradition in social thought, and a discussion of contemporary issues and debates.

Social Work (MSW)**MSW 510: Research Methods in Clinical Social Work Practice**

3 Credits

This course is designed to introduce social research methods in the context of social work practice. Research and evaluation are critical components of professional social work practice, and this foundation course hones in on critical thinking skills and examines methods of inquiry for testing theory and evaluating the effectiveness of social work practice. This course covers research skills and covers how research is integrated into social work practice. Steps in this process are covered in depth, and students will receive practice in moving from problem identification to research design to analysis to writeup. These are the same steps students will use for their capstone experience project at the end of the program. Research skills will be integrated with other areas of the MSW curriculum, and this course will examine the relationship between theory and research, the conceptualization of research questions and hypotheses, and elements of research design and analysis. It will introduce both quantitative and qualitative methodologies to build knowledge for practice.

Recommended Preparation: Students should have completed an undergraduate research methods course.

MSW 560: Applied Research in Clinical Social Work Practice

3 Credits

This advanced research course builds on material covered in the foundation research course about the design, development, and execution of sound scientific practices. Emphasis will be placed on areas of sampling, measurement, and proposal writing. Topics will include practical sampling design, question formation, questionnaire/interview construction and format, scaling, critiquing proposals, budget development, budget justification, timelines, etc. Special attention will be given to randomized clinical trials (RCT), with the understanding that this is often not feasible in social work practice for ethical and practical reasons. As a result, selection bias is of substantial concern and how results are written and interpreted need to consider the impacts of selection. This class will focus on the application of research methodology to increase student's understanding of the tradeoffs and limitations of various designs within the parameters of a naturalistic setting. The importance of balancing rigorous scientific methods with ethics, practicality and feasibility to answer important questions for social work practice will be emphasized. This course will also focus on

preparing students for their capstone experience and assignments will be tailored to student's individual projects.

Prerequisite: MSW 510 Recommended Preparation: Students should have completed the first year social work courses.

MSW 800: Foundations of Field Education 1

3 Credits

This course is taken at the same time MSW students are placed into their field experience placements. Topics will be introduced to students in class with their practical application being implemented in the concurrent field placement setting. Through guided supervision, the MSW student will be introduced to the role of a professional social worker and demonstrate clinical skills achieving the integration of classroom knowledge with professional practice skills. This course will address the social work field education placement experience, including the Field Learning Plan, caring for self in the Field Education Experience, the values and ethics of social work practice, professional boundaries, malpractice issues, approaches to supervision in social work practice, common problems in field, legal & regulatory issues in field, termination, evaluation, licensing and the Educational Policy and Accreditation Standards (EPAS) Standards. Field education provides MSW students the opportunity to work directly with field instructors, other professional colleagues, and client systems in micro, mezzo and macro practice settings applying the theories and concepts taught in the explicit curriculum of the program including various technologies supporting practice and service provision.

MSW 800A: Foundations of Field Education 1 Part A

1 Credits

This is the first in a three-part series for students to complete Foundations of Field Experience 1 in a part-time format. This course is taken at the same time MSW students are placed into their field experience placements. Topics will be introduced to students in class with their practical application being implemented in the concurrent field placement setting. Through guided supervision, the MSW student will be introduced to the role of a professional social worker and demonstrate clinical skills achieving the integration of classroom knowledge with professional practice skills. This course will address the social work field education placement experience, including the Field Learning Plan, caring for self in the Field Education Experience, the values and ethics of social work practice, professional boundaries, malpractice issues, approaches to supervision in social work practice, common problems in field, legal & regulatory issues in field, termination, evaluation, licensing and the Educational Policy and Accreditation Standards (EPAS) Standards. Field education provides MSW students the opportunity to work directly with field instructors, other professional colleagues, and client systems in micro, mezzo and macro practice settings applying the theories and concepts taught in the explicit curriculum of the program including various technologies supporting practice and service provision.

MSW 800B: Foundations of Field Education 1 Part B

1 Credits

This is the second in a three-part series for students to complete Foundations of Field Experience 1 in a part-time format. This course is taken at the same time MSW students are placed into their field experience placements. Topics will be introduced to students in class with their practical application being implemented in the concurrent field

placement setting. Through guided supervision, the MSW student will be introduced to the role of a professional social worker and demonstrate clinical skills achieving the integration of classroom knowledge with professional practice skills. This course will address the social work field education placement experience, including the Field Learning Plan, caring for self in the Field Education Experience, the values and ethics of social work practice, professional boundaries, malpractice issues, approaches to supervision in social work practice, common problems in field, legal & regulatory issues in field, termination, evaluation, licensing and the Educational Policy and Accreditation Standards (EPAS) Standards. Field education provides MSW students the opportunity to work directly with field instructors, other professional colleagues, and client systems in micro, mezzo and macro practice settings applying the theories and concepts taught in the explicit curriculum of the program including various technologies supporting practice and service provision.

Concurrent: MSW 800A

MSW 800C: Foundations of Field Education 1 Part C

1 Credits

This is the third in a three-part series for students to complete Foundations of Field Experience 1 in a part-time format. This course is taken at the same time MSW students are placed into their field experience placements. Topics will be introduced to students in class with their practical application being implemented in the concurrent field placement setting. Through guided supervision, the MSW student will be introduced to the role of a professional social worker and demonstrate clinical skills achieving the integration of classroom knowledge with professional practice skills. This course will address the social work field education placement experience, including the Field Learning Plan, caring for self in the Field Education Experience, the values and ethics of social work practice, professional boundaries, malpractice issues, approaches to supervision in social work practice, common problems in field, legal & regulatory issues in field, termination, evaluation, licensing and the Educational Policy and Accreditation Standards (EPAS) Standards. Field education provides MSW students the opportunity to work directly with field instructors, other professional colleagues, and client systems in micro, mezzo and macro practice settings applying the theories and concepts taught in the explicit curriculum of the program including various technologies supporting practice and service provision.

Concurrent: MSW 800A and 800B

MSW 801: Foundations of Field Education 2

3 Credits

This course is the student's second social work field education experience in the four-part field education practicum sequence and provides the MSW student with continued direct clinical practice experience in a clinical agency setting. Through guided supervision, the MSW student continues in the role of a professional social worker demonstrating clinical skills and achieving the integration of classroom knowledge with professional practice skills. This course will address the social work field education placement experience, including the Field Learning Plan, caring for self in the Field Education Experience, the values and ethics of social work practice, professional boundaries, malpractice issues, approaches to supervision in social work practice, common problems in field, legal & regulatory issues in field, termination, evaluation, licensing and the Educational Policy and Accreditation Standards (EPAS) Standards. Field education provides MSW students the opportunity to work directly with field instructors, other professional

colleagues, and client systems in micro, mezzo and macro practice settings applying the theories and concepts taught in the explicit curriculum of the program including various technologies supporting practice and service provision.

Prerequisite: MSW 800 or MSW 800A and MSW 800B and MSW 800C

MSW 801A: Foundations of Field Education 2 Part A

1 Credits

This is the first in a three-part series for students to complete Foundations of Field Experience 2 in a part-time format. This course is the student's second social work field education experience in the four-part field education practicum sequence and provides the MSW student with continued direct clinical practice experience in a clinical agency setting. Through guided supervision, the MSW student continues in the role of a professional social worker demonstrating clinical skills and achieving the integration of classroom knowledge with professional practice skills. This course will address the social work field education placement experience, including the Field Learning Plan, caring for self in the Field Education Experience, the values and ethics of social work practice, professional boundaries, malpractice issues, approaches to supervision in social work practice, common problems in field, legal & regulatory issues in field, termination, evaluation, licensing and the Educational Policy and Accreditation Standards (EPAS) Standards. Field education provides MSW students the opportunity to work directly with field instructors, other professional colleagues, and client systems in micro, mezzo and macro practice settings applying the theories and concepts taught in the explicit curriculum of the program including various technologies supporting practice and service provision.

Prerequisite: MSW 800 or MSW 800A and MSW 800B and MSW 800C

MSW 801B: Foundations of Field Education 2 Part B

1 Credits

This is the second in a three-part series for students to complete Foundations of Field Experience 2 in a part-time format. This course is the student's second social work field education experience in the four-part field education practicum sequence and provides the MSW student with continued direct clinical practice experience in a clinical agency setting. Through guided supervision, the MSW student continues in the role of a professional social worker demonstrating clinical skills and achieving the integration of classroom knowledge with professional practice skills. This course will address the social work field education placement experience, including the Field Learning Plan, caring for self in the Field Education Experience, the values and ethics of social work practice, professional boundaries, malpractice issues, approaches to supervision in social work practice, common problems in field, legal & regulatory issues in field, termination, evaluation, licensing and the Educational Policy and Accreditation Standards (EPAS) Standards. Field education provides MSW students the opportunity to work directly with field instructors, other professional colleagues, and client systems in micro, mezzo and macro practice settings applying the theories and concepts taught in the explicit curriculum of the program including various technologies supporting practice and service provision.

Prerequisite: MSW 800 or MSW 800A and MSW 800B and MSW 800C
Concurrent: MSW 801A

MSW 801C: Foundations of Field Education 2 Part C

1 Credits

This is the third in a three-part series for students to complete Foundations of Field Experience 2 in a part-time format. This course is the student's second social work field education experience in the four-part field education practicum sequence and provides the MSW student with continued direct clinical practice experience in a clinical agency setting. Through guided supervision, the MSW student continues in the role of a professional social worker demonstrating clinical skills and achieving the integration of classroom knowledge with professional practice skills. This course will address the social work field education placement experience, including the Field Learning Plan, caring for self in the Field Education Experience, the values and ethics of social work practice, professional boundaries, malpractice issues, approaches to supervision in social work practice, common problems in field, legal & regulatory issues in field, termination, evaluation, licensing and the Educational Policy and Accreditation Standards (EPAS) Standards. Field education provides MSW students the opportunity to work directly with field instructors, other professional colleagues, and client systems in micro, mezzo and macro practice settings applying the theories and concepts taught in the explicit curriculum of the program including various technologies supporting practice and service provision.

Prerequisite: MSW 800 or MSW 800A and MSW 800B and MSW 800C
Concurrent: MSW 801A and MSW 801B

MSW 802: Specialized Field Education 1

3 Credits

This is the third course in the four-part field education practicum sequence comprised of a two-part foundation first year sequence and a two-part advanced practice second year sequence. Field education is the signature pedagogy for social work education. The Specialized Field Education I course is the student's advanced social work field education experience. The Specialized Field Education I course is the advanced field placement in the continuation of the MSW student's social work field education experience. This course builds upon the work completed in the foundation Field Education sequence by providing the MSW student with increased independent direct clinical practice experience in a clinical agency setting. The MSW student will directly fulfill the role of a professional social worker by utilizing skills in the maintenance of professional boundaries and ethics while managing a caseload of assigned clients. Additionally, the MSW student will begin work on their graduate Capstone Project during the Specialized Field Education I course. The student will continue to attend a weekly synchronous one-hour on-line seminar session for the continued integration of classroom knowledge with professional practice skills. Field education provides MSW students the opportunity to work directly with field instructors, other professional colleagues, and client systems in micro, mezzo and macro practice applying the theories and concepts taught in the explicit curriculum of the program including various technologies supporting practice and service provision.

Prerequisite: MSW 801 or MSW 801A and MSW 801B and MSW 801C

MSW 802A: Specialized Field Education 1 Part A

1 Credits

This is the first in a three-part series for students to complete Specialized Field Education 1 in a part-time format. This is the third course in the

four-part field education practicum sequence comprised of a two-part foundation first year sequence and a two-part advanced practice second year sequence. Field education is the signature pedagogy for social work education. The Specialized Field Education I course is the student's advanced social work field education experience. The Specialized Field Education I course is the advanced field placement in the continuation of the MSW student's social work field education experience. This course builds upon the work completed in the foundation Field Education sequence by providing the MSW student with increased independent direct clinical practice experience in a clinical agency setting. The MSW student will directly fulfill the role of a professional social worker by utilizing skills in the maintenance of professional boundaries and ethics while managing a caseload of assigned clients. Additionally, the MSW student will begin work on their graduate Capstone Project during the Specialized Field Education I course. The student will continue to attend a weekly synchronous one-hour on-line seminar session for the continued integration of classroom knowledge with professional practice skills. Field education provides MSW students the opportunity to work directly with field instructors, other professional colleagues, and client systems in micro, mezzo and macro practice applying the theories and concepts taught in the explicit curriculum of the program including various technologies supporting practice and service provision.

Prerequisite: MSW 801 or MSW 801A and MSW 801B and MSW 801C

MSW 802B: Specialized Field Education 1 Part B

1 Credits

This is the second in a three-part series for students to complete Specialized Field Education 1 in a part-time format. This is the third course in the four-part field education practicum sequence comprised of a two-part foundation first year sequence and a two-part advanced practice second year sequence. Field education is the signature pedagogy for social work education. The Specialized Field Education I course is the student's advanced social work field education experience. The Specialized Field Education I course is the advanced field placement in the continuation of the MSW student's social work field education experience. This course builds upon the work completed in the foundation Field Education sequence by providing the MSW student with increased independent direct clinical practice experience in a clinical agency setting. The MSW student will directly fulfill the role of a professional social worker by utilizing skills in the maintenance of professional boundaries and ethics while managing a caseload of assigned clients. Additionally, the MSW student will begin work on their graduate Capstone Project during the Specialized Field Education I course. The student will continue to attend a weekly synchronous one-hour on-line seminar session for the continued integration of classroom knowledge with professional practice skills. Field education provides MSW students the opportunity to work directly with field instructors, other professional colleagues, and client systems in micro, mezzo and macro practice applying the theories and concepts taught in the explicit curriculum of the program including various technologies supporting practice and service provision.

Prerequisite: MSW 801 or MSW 801A and MSW 801B and MSW 801C
Concurrent: MSW 802A

MSW 802C: Specialized Field Education 1 Part C

1 Credits

This is the third in a three-part series for students to complete Specialized Field Education 1 in a part-time format. This is the third

course in the four-part field education practicum sequence comprised of a two-part foundation first year sequence and a two-part advanced practice second year sequence. Field education is the signature pedagogy for social work education. The Specialized Field Education I course is the student's advanced social work field education experience. The Specialized Field Education I course is the advanced field placement in the continuation of the MSW student's social work field education experience. This course builds upon the work completed in the foundation Field Education sequence by providing the MSW student with increased independent direct clinical practice experience in a clinical agency setting. The MSW student will directly fulfill the role of a professional social worker by utilizing skills in the maintenance of professional boundaries and ethics while managing a caseload of assigned clients. Additionally, the MSW student will begin work on their graduate Capstone Project during the Specialized Field Education I course. The student will continue to attend a weekly synchronous one-hour on-line seminar session for the continued integration of classroom knowledge with professional practice skills. Field education provides MSW students the opportunity to work directly with field instructors, other professional colleagues, and client systems in micro, mezzo and macro practice applying the theories and concepts taught in the explicit curriculum of the program including various technologies supporting practice and service provision.

Prerequisite: MSW 801 or MSW 801A and MSW 801B and MSW 801C
Concurrent: MSW 802A and MSW 801B

MSW 811: Foundations in Clinical Social Work Practice 1

3 Credits

This course is the first of two in the foundations of clinical social work practice sequence. This course will provide first year MSW students with foundational concepts, knowledge, values, and skills in clinical social work practice with individuals, families, groups, organizations, and communities. Particular attention is given to the needs of at-risk and vulnerable populations in the context of age, ability, culture, education, ethnicity, gender identity, identity, nationality/national origin, race, religion/spirituality, sexual identity, sexual orientation, socioeconomic status or any other distinguishing characteristics or traits in the delivery of competent and effective clinical social work practice. The classroom content of Foundations in Clinical Social Work Practice is integrated with the student's field experience as signature pedagogy of the social work curriculum.

MSW 812: Foundation in Clinical Social Work Practice 2

3 Credits

This course is the second of two in the foundations of clinical social work practice sequence. This course will provide an in-depth exploration of the foundational concepts and knowledge of the ethics, values, techniques, skills, and roles in clinical social work practice with individuals, families, groups, organizations, and communities by generalist and clinical practitioners. Students will explore the application of foundational concepts, practice knowledge and competence for work with families, groups, organizations, and communities. Integral to both courses in the foundations sequence, is particular attention given to the needs of at-risk and vulnerable populations in the context of age, ability, culture, education, ethnicity, gender identity, identity, nationality/national origin, race, religion/spirituality, sexual identity, sexual orientation, socioeconomic status or any other distinguishing characteristics or traits in the delivery of competent and effective clinical social work practice.

Prerequisite: MSW 811 Foundations in Clinical Social Work Practice 1

MSW 813: Human Development in the Social Environment

3 Credits

This course explores conceptual frameworks in human development throughout the life span. An emphasis is placed on the social, cultural, political, historical, and economic forces that shape development. Major theoretical perspectives from sociology, psychology, anthropology, and economics will be covered to explain both internal dynamics and external forces that shape human behavior. In addition, this course examines the physical, cognitive, and emotional development of the individual from infancy through adolescence and focuses on the continuation of growth, change, and adaptation throughout young adulthood, middle age, and old age. This course is an essential foundation for social work practice with its person in environment orientation for understanding human behavior.

MSW 814: Social Welfare Policy

3 Credits

This course surveys the history of social welfare policy, services, and the social work profession in the United States. It explores current social welfare issues in the context of their history and analyzes the values and assumptions that support different approaches. Existing welfare programs and institutions are examined in the social, economic, political and cultural contexts in which they have evolved. The course examines the development of cash assistance and social service programs in light of the long legacy of poverty, racism, sexism, and other forms of structure oppression, and their enduring effects on U.S. society today. This examination provides perspective on the source of conflict and consensus in American history. The course also traces the roles that social workers have played in the formulation and implementation of social welfare policy-as well as their role in promoting social movements opposed to existing policy-and links these historical examples to contemporary policy practice.

MSW 815: Clinical Social Work Practice Across the Lifespan 1

3 Credits

This course will provide students with foundational concepts, knowledge, values, and skills in clinical social work practice with individuals, families, groups, organizations, and communities. In the first semester, the course emphasis is on the development of foundational concepts, practice knowledge, and competence for work with individuals. An introduction to generalist social work principles emphasizing a systems perspective, the continuum of service delivery levels and modalities, and a commitment to underserved and vulnerable populations. The course content is focused on teaching basic practice skills; students are exposed simultaneously to the theory, research, and necessary skills required to work with individuals, and families in the engagement, assessment, intervention, termination, and evaluation phases of treatment. The person-in-environment and systems approach to practice is emphasized, highlighting the necessity for multilevel intervention. Course content includes micro and mezzo social systems thinking applied to the assessment of socio-structural institutions and organizations as well as change strategies and fundamentals of group and community organizational practice, with an emphasis on multi-cultural and anti-oppression perspectives in clinical social work practice. The importance of research to social work practice is introduced as it applies to the understanding of client problems and the choice and effectiveness of an intervention. In addition, knowledge of professional identity, the

profession's ethical standards, and the ethical dilemmas that occur as social work values and professional ethics are operationalized in practice.

MSW 816: Clinical Social Work Practice Across the Lifespan 2

3 Credits

This foundation practice course is the second in a two-course sequence designed to provide M.S.W. students with foundational knowledge, values, and skills in social work practice with families, groups, organizations, and communities. In the first course, the emphasis was on the development of practice knowledge and skills in the areas of engagement, assessment, goal setting, contracting, intervention and evaluation with individuals. In the second course, students further develop this knowledge and skill base and learn about its use in working with families, groups, organizations, and communities. Attention to the implications of race, culture, ethnicity, gender, socioeconomic background, age, sexual orientation, religion, and disabilities in social work practice continues to be an integral part of foundation practice learning. Students learn about how core professional values, including a commitment to social change to meet socially recognized needs, respect and appreciation for individual and group differences, and promotion of social justice and economic, physical, and mental well-being of all in society, apply to practice with larger systems. Through the use of assigned readings and discussion posts, emphasis is placed on principles of ethical practice, cultural awareness in practice, and the promotion of access to services for people with the greatest social and economic needs. Throughout the course, the impact of inequality and oppression in the provision of services with families, groups, communities, and organizations and in the dynamics of practice settings is explored, and students develop an awareness of the impact of difference and diversity in assessment and ongoing social work practice with families, groups, organizations, and communities. Students learn the unique role that families, groups, organizations, and communities work to play in the continuum of social work practice methodologies. In addition, they learn to apply a strengths perspective in social work practice occurring in the family, group, organizational, and community settings, with an emphasis on vulnerable and marginalized populations. The themes of practicing from a person-in-environment and a strength-based perspective are continued in this course. Students study how practice with groups can, directly and indirectly, promote social and economic justice. Particular emphasis is placed on selecting interventions that have been shown, through empirical evidence, to be effective. Students also gain an understanding of how to provide culturally sensitive practice and critically analyze ethical dilemmas that arise in social work practice with groups.

Prerequisite: MSW 815 Recommended Preparation: Students should have successfully completed the first semester MSW courses.

MSW 819: Diverse Populations in Clinical Social Work Practice

3 Credits

This course will explore the origins and development of selected social variables characterizing the diversity dimensions (including race, ethnicity, class, gender identity, gender expression, geography and nationality) in contemporary U.S. society. Social and behavioral science theories and research findings on the allocation of different roles, status, and opportunities to these populations will be examined. Students will use a multicultural framework to examine power, privilege, discrimination, and oppression. This course will emphasize that effective social work practice with diverse groups involves understanding professional ethics

in the context of the values of both the dominant society and the ethnic community.

Recommended Preparation: Students should have an introductory class in clinical social work prior to enrolling.

MSW 850: Diagnosis and Assessment in Clinical Social Work Practice

3 Credits

The Diagnosis and Assessment in Clinical Social Work Practice course addresses the etiology, nature, course and treatment of mental health and substance use disorders across the life development cycle. Diagnosis and assessment will be examined through the diversity lenses of age, ability, color, culture, education, ethnicity, family structure, gender identity, gender expression, identity, marital/relationship status, nationality/national origin, race, religion/spirituality, sex, sexual identity, sexual orientation, socioeconomic status or other distinguishing characteristics or traits and other aspects of diversity and how they shape how symptoms of mental illness are experienced, interpreted and expressed. An extensive selection from the major categories of mental health and substance use disorders in the Diagnostic and Statistical Manual of Mental Disorders (DSM) will be addressed in the course, although it will not be possible to examine all disorders listed in the DSM in class. Understanding and applying the DSM manual as a clinical assessment tool, along with an overview to psychopharmacology, and the nature and role of risk and protective factors associated with suicidal and violent behavior will also be addressed. Particular emphasis will be placed on the role of culture in the diagnostic process.

Prerequisite: MSW 506 Recommended Preparation: Successful completion of the first year MSW courses or advanced standing status.

MSW 855: Essential Skills for Clinical Social Work Practice

3 Credits

The Essential Skills for Clinical Social Work Practice course is an advanced graduate course intended for second-year MSW students to reflect, review and consolidate their graduate studies into a coherent and structured plan of practice as social work professionals. The Essential Skills of Clinical Social Work Practice course, reviews, connects and links together all the vital composite elements presented in the MSW graduate course of study, enabling the MSW student to formulate a deliberative plan of practice to guide their beginning social work career. The course covers the operationalization of specific elements into a plan of social work practice: values/ethics, people skills, practice skills, clinical skills and legal/regulatory issues. At the conclusion of the course, students will have prepared a coherent plan of practice.

Prerequisite: MSW 850 Recommended Preparation: Successful completion of the first year MSW classes.

MSW 865: Clinical Social Work Practice in Urban and Rural Settings

3 Credits

This MSW course provides students with knowledge in clinical social work practice in the area of urban versus rural settings. The course provides a professional foundation in content related to rural and urban communities that impact clinical social work practice. Within this context, the course addresses rural and urban individuals and families, groups, organizations and communities, and social work practice related to these systems. An understanding of rural and urban clinical practice settings including content related to social research, social work values

and ethics, cultural and ethnic diversity, and social and economic justice related to rural populations and communities. Social work practitioners must understand the unique needs of the local community they serve, and adjust their focus to address the specific needs of their locality. An in-depth overview of the key differences between urban and rural social work, and the unique social problems that each experience is needed to help professional social workers decide which practice area meets their professional goals and how to effectively meet the needs of their clients.

Prerequisite: MSW 560 Recommended Preparation: Successful completion of the 1st year MSW program.

MSW 870: Clinical Social Work Practice with Children and Families 1

3 Credits

This course will examine core theories, dynamics, functions, policies, and ethics associated with the management of private and public child welfare services are analyzed and examined with a particular focus on the knowledge, skills, and competencies necessary to successfully lead organizations providing such services in the environment of today and the future. Emphasis is on the adaptation of generic external (public and community relations, media, and legislative relations, etc.) skills to the child welfare setting and specific issues associated with the management of child welfare functions, such as foster care and adoption, residential care, family preservation, forensic investigations in interfamilial and institutional settings, legal affairs, programs treating the co-occurring disorder, and others.

Prerequisite: MSW 816 Recommended Preparation: Successful completion of first year in MSW program coursework.

MSW 871: Clinical Social Work Practice with Children and Families 2

3 Credits

This course covers the major problems of at-risk children and youth, including cognitive, communication, behavioral and emotional problems, attachment disorders, trauma, substance abuse, and developmental disabilities noted in the current DSM. Students learn about normal child and adolescent development in the context of the family life cycle, culture, and society. Students will examine generalist principles of social work intervention with children and adolescents, in the context of the uniqueness of children as clients, planning with parents and/or caregivers, and the centrality of the family. Utilizing bio-psycho-social-spiritual assessments, students will examine treatment models, develop and implement a treatment plan. Students also learn about evidence-informed models, examine social policy issues and helping systems serving children and adolescents, and discuss the social worker's role on treatment teams and advocacy.

Prerequisite: 870 Recommended Preparation: Successful completion of first year MSW course work.

MSW 875: Policy Issues with Children and Families

3 Credits

The course examines state and federal laws that govern the funding and operation of child welfare systems; the history of child welfare policies; and, the legal, political, and social forces that influence the structure and function of child welfare systems in the United States. The course examines the knowledge base of child maltreatment- extent, incidence, causes, consequences, and the effectiveness of interventions and whether and how the knowledge base is applied to federal and state

policies for children and families. Specifically, students will identify the features of child welfare laws that currently drive policies for children and families. Students will develop knowledge about the major challenges of providing safety, permanency, and well-being to children in foster care and the state and federal proposals designed to address those challenges.

Prerequisite: MSW 814 Recommended Preparation: Successful completion of first year MSW program coursework.

MSW 876: Trauma and Treatment with Children and Families

3 Credits

This course will cover trauma theories and treatments, and conduct an in-depth critical examination of different populations affected by trauma including child abuse survivors, war veterans, and domestic violence survivors, victims of accidents or crimes, and communities and schools that are devastated by abuse, neglect, and addiction. Students will analyze theoretical frameworks for understanding trauma, including neurobiological aspects and types of trauma, the history of traumatology, and the impact of trauma on individuals, families, and communities. Trauma-informed care models and evidence-based trauma practice models with an emphasis on strengths, resiliency, coping, multicultural issues, and cultural competency will be examined. The overall purpose of the course is to examine relevant theories of trauma and recovery and relate them to social work practice.

Recommended Preparation: Successful completion of the first year MSW courses

MSW 880: Clinical Social Work Practice in Mental Health and Substance Use 1

3 Credits

This course provides students with knowledge of assessment based on the current Diagnostic and Statistical Manual of Mental Disorders, published by the American Psychiatric Association; psychotropic medications; and social worker roles when interacting with people with mental health issues and interdisciplinary teams. This course will provide students with an understanding of the correlates of the physiological and psychological effects of drugs and mental health focusing on the significance of treatment planning in diverse settings. Clinical Social work skills and knowledge of the individual, group, and family counseling strategies as they are applied to behavior change and relapse prevention. Students learn about the diagnostic criteria of mental health, substance use and addictive behavior, models of etiology, and approaches to treatment. Clinical social work practice in Mental Health and Substance Use is a specialization track that will provide students with foundational concepts, knowledge, values, and skills in clinical social work practice with mental health and substance abuse. In the first semester, the course emphasis is on the development of practice knowledge and competency for working with mental health and substance use. In the second semester, the emphasis shifts to diagnosing, treatment planning, intervention, and evaluation. Integral to both course content and skills with a special emphasis on the identification of theories, practices and/or policies that promote social justice, illuminate injustices and are consistent with scientific and professional knowledge. Through the use of a variety of instructional methods, this course will support students in developing a vision of social justice, learning to recognize and reduce mechanisms that support oppression and injustice, working toward social justice processes, applying intersectionality and intercultural frameworks and, strengthening critical consciousness, self-knowledge and self-awareness to facilitate learning. Consideration

will be given to the ways in which diversity factors such as age, race, ethnicity, disadvantage, gender, sexual orientation, sexual identity, class, immigration status, ability, family status, geographic location, ethnicity and, culture interact with and impact health, mental health and, behavioral health impact assessment and screening. Culturally responsive engagement in the assessment process will be a focus.

Prerequisite: MSW 816 Recommended Preparation: Students should have successfully completed the first year MSW courses

MSW 881: Clinical Social Work Practice in Mental Health and Substance Use 2

3 Credits

This course will provide students with foundational concepts, knowledge, values, and skills in clinical social work practice with mental health and substance abuse. Emphasis is on the development of practice knowledge and competency for working with mental health and substance use, and the diagnosing, treatment planning, intervention and evaluation. Particular attention is given to the needs of at-risk and vulnerable populations in the context of age, ability, culture, education, ethnicity, gender identity, identity, nationality/national origin, race, religion/spirituality, sexual identity, sexual orientation, socioeconomic status or any other distinguishing characteristics or traits in the delivery of competent and effective social worker.

Prerequisite: MSW 880

MSW 885: Policy Issues in Mental Health and Substance Use

3 Credits

Policy Issues in Mental Health and Substance Use course focuses on contemporary policy issues related to mental health and substance use including social determinants of mental health, treatment and access to care, rights and privacy, systems transformation, and disparities in care are examined in this course. The role of social workers in policy advocacy, the history and evolution of mental health and substance use policy, and recent policy proposals are discussed. Students will learn to analyze mental health and drug and alcohol policies and advocate for policies that advance human rights and social, economic, and environmental justice. The course also describes appropriate counseling strategies when working with clients with addiction and co-occurring disorders in a multicultural society.

Prerequisite: MSW 814: Social Welfare Policy Recommended Preparation: Successful completion of first year MSW program coursework.

MSW 886: Trauma and Treatment in Mental Health and Substance Use

3 Credits

The course explores the multi-systemic impact of trauma and substance use on the functioning of individuals, families, and communities. Emphasizes the treatment of trauma and substance use across the lifespan with diverse populations utilizing trauma-informed approaches, including Motivational Interviewing and cognitive behavioral interventions will be focusing on enhancing awareness of trauma in mental health and substance use; assessing and responding to the needs of clients who encounter trauma; and changing systems to become more responsive to those impacted by life experiences. Exploration of factors known to promote resilience and well-being will be emphasized and examined throughout the course. Trauma-informed care models and evidence-based trauma practice models with an emphasis on strengths, resiliency,

coping, multicultural issues, and cultural competency will also be explored.

Prerequisite: MSW 885

MSW 894: Specialized Field Education 2

3 Credits

This is the fourth course in the four-part field education practicum sequence comprised of a two-part foundation first year sequence and a two-part specialized practice second year sequence. Field education is the signature pedagogy for social work education. This course builds upon the work initiated in prior field education courses by continuing to provide the MSW student with increased independent direct clinical practice experience in a clinical agency setting. The MSW student will directly fulfill the role of a professional social worker by utilizing skills in the maintenance of professional boundaries and ethics while managing a caseload of assigned clients. Field education provides MSW students the opportunity to work directly with field instructors, other professional colleagues, and client systems in micro, mezzo and macro practice applying the theories and concepts taught in the explicit curriculum of the program including various technologies supporting practice and service provision. This course will also provide guidance and structure for the MSW student to complete their graduate Capstone Project. Students will identify a problem or service gap in their field practice setting. They will then analyze this problem or service gap and propose a solution or policy change. The student will produce a written analysis of their project and an oral presentation designed as a professional conference presentation.

Prerequisite: MSW 802 or MSW 802A and MSW 802B and MSW 802C

MSW 894A: Specialized Field Education 2 Part A

1 Credits

This is first in a three part series for students to complete Specialized Field Education 2 in a part-time format. This is the fourth course in the four-part field education practicum sequence comprised of a two-part foundation first year sequence and a two-part specialized practice second year sequence. Field education is the signature pedagogy for social work education. This course builds upon the work initiated in prior field education courses by continuing to provide the MSW student with increased independent direct clinical practice experience in a clinical agency setting. The MSW student will directly fulfill the role of a professional social worker by utilizing skills in the maintenance of professional boundaries and ethics while managing a caseload of assigned clients. Field education provides MSW students the opportunity to work directly with field instructors, other professional colleagues, and client systems in micro, mezzo and macro practice applying the theories and concepts taught in the explicit curriculum of the program including various technologies supporting practice and service provision. This course will also provide guidance and structure for the MSW student to complete their graduate Capstone Project. Students will identify a problem or service gap in their field practice setting. They will then analyze this problem or service gap and propose a solution or policy change. The student will produce a written analysis of their project and an oral presentation designed as a professional conference presentation.

Prerequisite: MSW 802 or MSW 802A and MSW 802B and MSW 802C

MSW 894B: Specialized Field Education 2 Part B

1 Credits

This is second in a three part series for students to complete Specialized Field Education 2 in a part-time format. This is the fourth course in the four-part field education practicum sequence comprised of a two-part foundation first year sequence and a two-part specialized practice second year sequence. Field education is the signature pedagogy for social work education. This course builds upon the work initiated in prior field education courses by continuing to provide the MSW student with increased independent direct clinical practice experience in a clinical agency setting. The MSW student will directly fulfill the role of a professional social worker by utilizing skills in the maintenance of professional boundaries and ethics while managing a caseload of assigned clients. Field education provides MSW students the opportunity to work directly with field instructors, other professional colleagues, and client systems in micro, mezzo and macro practice applying the theories and concepts taught in the explicit curriculum of the program including various technologies supporting practice and service provision. This course will also provide guidance and structure for the MSW student to complete their graduate Capstone Project. Students will identify a problem or service gap in their field practice setting. They will then analyze this problem or service gap and propose a solution or policy change. The student will produce a written analysis of their project and an oral presentation designed as a professional conference presentation.

Prerequisite: MSW 802 or MSW 802A and MSW 802B and MSW 802C
Concurrent: MSW 894A

MSW 894C: Specialized Field Education 2 Part C

1 Credits

This is third in a three part series for students to complete Specialized Field Education 2 in a part-time format. This is the fourth course in the four-part field education practicum sequence comprised of a two-part foundation first year sequence and a two-part specialized practice second year sequence. Field education is the signature pedagogy for social work education. This course builds upon the work initiated in prior field education courses by continuing to provide the MSW student with increased independent direct clinical practice experience in a clinical agency setting. The MSW student will directly fulfill the role of a professional social worker by utilizing skills in the maintenance of professional boundaries and ethics while managing a caseload of assigned clients. Field education provides MSW students the opportunity to work directly with field instructors, other professional colleagues, and client systems in micro, mezzo and macro practice applying the theories and concepts taught in the explicit curriculum of the program including various technologies supporting practice and service provision. This course will also provide guidance and structure for the MSW student to complete their graduate Capstone Project. Students will identify a problem or service gap in their field practice setting. They will then analyze this problem or service gap and propose a solution or policy change. The student will produce a written analysis of their project and an oral presentation designed as a professional conference presentation.

Prerequisite: MSW 802 or MSW 802A and MSW 802B and MSW 802C
Concurrent: MSW 894A and MSW 894B

Sociology (SOC)

SOC 500: Introduction to Graduate Study in Sociology

1 Credits

Required of all incoming graduate students in sociology.

SOC 501: Proseminar in Sociology

3 Credits/Maximum of 6

An in-depth introduction to the major specialty areas of Sociology.

Prerequisite: admission to the graduate program

SOC 502: Theories of Society I

3 Credits

Review and analysis of trends and controversies in sociological theory from late eighteenth-century beginnings through the nineteenth century.

SOC 503: Theories of Society II

3 Credits

Review and analysis of trends and controversies in sociological theory in the twentieth century.

SOC 512: Criminological Theories

3 Credits

Survey of theoretical and substantive issues in deviance and criminology, with emphasis on critical review of theories. SOC (CRIM) 512 Criminological Theories (3) This graduate course in Criminological Theories is designed to provide students with a broad understanding of the major theories that have animated the field of criminology since its inception. The course traces the development of criminological theories from the early 20th century to the present and provides students with a targeted exposure to empirical studies that have tested these theories.

Cross-listed with: CRIM 512

SOC 513: Sociological Research Methods

3 Credits

Critical review of methodological issues; research designs; analysis and interpretation of findings.

SOC 516: Education and Demographic Change

3 Credits

Education is one of the most important factors affecting major demographic shifts and processes worldwide, including the first and second demographic transitions. If, as the old sociological adage goes "demography is destiny," then our destiny is educationally transformed demography. Interdisciplinary research across demography, sociology, neuropsychology, and epidemiology is developing a strong research literature about how the thinking style, behavior, and attitudes of the educated human radically change fundamental dynamics underlying the world's population. The whole way in which we come to our jobs, spouses, and lifestyles; how many children we have and how we raise them; how long we are likely to live, and what will be our eventual demise

are all heavily influenced by how much education we have had. The collective force of widespread education and its influence on rising cognitive abilities, scripts for living, and economic well-being are creating a distinctly new type of human population with major benefits and future challenges for a sustainable human population. At the same time, individuals' schooling is also influenced by demographic change. This seminar covers key concepts, theories, and methodological issues related to the intersection of demographical and cultural changes from the education revolution and their impact on subsequent demographic processes.

Cross-listed with: CIED 516, EDTHP 516

SOC 518: Survey Methods I: Survey Design

3 Credits

Research design of social, behavioral and health surveys. PL SC (SOC) 518 Survey Methods I: Survey Design (3) This course is intended to provide graduate students the background to both evaluate published research using survey methods, and – when combined with additional training – to design their own surveys to collect data for their own research. Students will learn the essentials of sampling, questionnaire design, and how surveys may be implemented in different modes: telephone, face to face interviews, mail or other self-administered modes, and the internet. The course will emphasize how decisions of research design have important implications for the validity, reliability, and quantity of data that will be analyzed to answer key questions in the social, behavioral and health sciences. Sample design: 2 weeks; Questionnaire design and item analysis: 2 weeks; Telephone Surveys: 2 weeks; Face to face surveys: 2 weeks; Self administered and mail surveys: 2 weeks; Internet Surveys: 2 weeks; Ethics and human subjects protection: 1 week.

Cross-listed with: PLSC 518

SOC 519: Survey Methods II: Analysis of Survey Data

3 Credits

Intermediate course on the statistical analysis of survey data: topics include weighting, complex surveys, missing data, and contextual analysis. PL SC (SOC) 519 Survey Methods II: Analysis of Survey Data (3) This is an intermediate level course in quantitative analysis. It is intended for graduate students who have completed 1-2 semesters of graduate-level statistics (not general research methods) and who are interested in the application of social statistics to the unique aspects of data collected by way of surveys. Surveys have a combination of qualities that represent challenges to valid inference. These include cluster and stratified sampling, under-representation of some groups due to differential response rates, missing data due to item non-response, cross-sectional design, and coarse measurement. Quite often we use surveys to test theories that the original survey designer did not intend to address, raising issues of validity and reliability of measurement. At the same time, surveys offer a number of opportunities and, when combined with other surveys (pooled cross sections) or merged with contextual data, can address a wide range of theoretical puzzles in the social sciences. This course provides an introduction to techniques in applied statistics that have developed specifically to address the special features of survey data. Examples of such techniques are: use of design weights, post-stratification weights, merging surveys with other surveys or auxiliary data, missing data imputation, challenges of causal inference. The class will blend an understanding of the core statistical issues with an emphasis on acquiring an intuition for the theory underlying the statistical models rather than focusing on proofs and estimation.

This will provide a foundation for frequent hands-on applications in this seminar and for enrollment in more advanced or more in-depth courses offered by the Statistics department and the various social science departments.

Prerequisite: PL SC503 or SOC 575
Cross-listed with: PLSC 519

SOC 521: Family Demography

3 Credits

Current family demographic research on nuptiality, divorce, household composition, female employment, migration, and fertility.

SOC 522: Demography of the Life Course

3 Credits

The theoretical bases, critical concepts, and methods of life course analysis in the study of demographic transitions.

Prerequisite: SOC 423 , SOC 473

SOC 523: Internal and International Migration

3 Credits

Examination of theories, frameworks, and policies related to internal and international migration causes and consequences in developed and developing nations.

Prerequisite: SOC 423 or prior work in population or human ecology

SOC 524: The Demography of Human Fertility

3 Credits

Overview of major issues and methodological approaches in the demographic study of human fertility in developing and developed countries. SOC 524 The Demography of Human Fertility (3) This course provides a graduate-level overview of the study of human fertility, one of the three basic demographic processes (i.e., fertility, mortality, migration) emphasized in the field of demography. The first part of the course will focus on the timing and nature of historical and contemporary fertility declines. The major theories that have been set forth to explain why fertility declines occur will be studied, as will empirical evidence that bears on the applicability of the theories to fertility patterns in specific areas of the world. The second component of the course will focus on fertility patterns in the contemporary United States. Theoretical perspectives on the determinants of fertility in advanced industrial countries will be examined. Variation in fertility by race, ethnicity, and various social characteristics will be addressed. In addition, students will learn how to measure fertility with various types of data (e.g., surveys, vital statistics, censuses) and they will be exposed to a variety of research methodologies employed to assess the nature and determinants of fertility patterns. The class will be organized as a seminar. Major requirements are class participation, leadership of one or more class sessions, and completion of a class project. The class project can be an empirical research paper, a research proposal, or a literature review. This course covers core content that is essential for demographic training. The course has been approved by the Dual-Title Graduate Degree Program in Demography as a core seminar on demographic structure and change; it can therefore be used by students in that program (in addition to students in Sociology) to fulfill the requirements for the degree.

SOC 525: Immigration, Assimilation, and Inequality

3 Credits

Examine theories, research, and policies on the incorporation of immigrants and their descendants. SOC 525 Immigration, Assimilation, and Inequality (3) Over the last several decades, the diversity of American society has increased substantially as a result of immigration from Latin America, Asia, and other world regions. This has raised numerous questions about the consequences of immigration and the long-term prospects of immigrants and their descendants. The major objective of this course is to provide the foundation for a sociological understanding of the process of assimilation (or incorporation), especially in relation to the structure of opportunities and the reproduction of inequality. This will be accomplished through a survey of contemporary theoretical perspectives, and both quantitative and qualitative studies that evaluate their merits. Although sociology has embraced the study of assimilation since its inception, we will also draw on other disciplines to explore various topics associated with educational attainment, economic mobility, social incorporation, political incorporation, family formation, and ethno-racial identification. Students will be evaluated on the basis of their engagement with weekly readings, as revealed by the quality of their participation in discussions and their written response to weekly essay questions. Students will also be required to write a paper on a topic of their choosing. This paper may be a research proposal, a literature review or a research study. The course will be offered every other year. It may serve as an elective in Sociology and the Dual-Title Graduate Degree Program in Demography as a core seminar on demographic processes.

SOC 526: Health Disparities

3 Credits

This course provides an overview of social factors that lead to demographic disparities in health. H P A(SOC) 526 Health Disparities (3) This course provides a broad exploration of U.S. health disparities. In particular, it examines several types of U.S. health disparities that emerge as a result of individuals' race/ethnicity, socioeconomic status, nativity status and gender. The course focuses on theoretical and methodological strategies for studying health disparities as well as empirical evidence supporting the existence of different health disparities and explanations for understanding and ameliorating them. Students will summarize and discuss weekly readings and apply course materials to understand the state of the field and to carry out an original research project on a particular health disparity that interests them. This course fulfills basic seminar requirements in the Sociology graduate curriculum and serves as a process course for the interdisciplinary Demography dual-title graduate curriculum.

Cross-listed with: HPA 526

SOC 527: Migration, Urbanization, and Policy in the Developing World

3 Credits

This course examines the dynamics of migration and urbanization processes, as well as their policy implications, in non-industrialized regions of the world.

Cross-listed with: AFR 527

SOC 528: Demographic Change and Public Policy

3 Credits

This course will examine the interplay between demographic trends and public policies, largely in the United States. Students will be exposed to the two-way relationship between public policy and demographic change, considering both the impact of policies on demographic outcomes as well as the effect of changing demographic structures on public policy development. Demographic trends play an important role in driving public policy change, especially given the extent to which shifts in population composition emphasize different areas of public policy. Similarly, public policies have implications for outcomes related to population structure and composition, including health, life expectancy, marriage, childbearing, migration, aging, disability, and retirement. Inequality across race, ethnicity, nativity, gender, socioeconomic status, and geographic location is a common thread that runs through each of these relationships. The course provides a detailed examination of each process. The course will involve an introduction to demography and public policy and will cover topics including immigration, health policy and life expectancy, family policies, family structure and fertility, migration and immigration policy, race and racism, housing and urban policy, population aging and pensions, social policy and inequality, and climate and environmental policy. Readings will be a mix of scholarly articles and popular press pieces. Class meetings involve significant expectations for student discussion and participation. Students will complete a policy project that engages with a contemporary demographic issue.

Cross-listed with: PPOL 528

SOC 529: Seminar in Race and Ethnicity

3 Credits

Reviews the status of U.S. racial and ethnic minority groups; analyzes factors influencing inequality and inter-group relations. SOC 529 Seminar in Race and Ethnicity (3) The seminar opens with a review of the status of central racial and ethnic minority groups in the United States: African Americans, Latinos, Asian Americans, American Indians. Educational and economic status are considered, along with such factors as family structure, geographical location, residential segregation, language, and involvement with the criminal justice system. Institutional patterns that potentially contribute to observed statuses are reviewed. Two groups of African Americans receive special attention: the urban "underclass" that sits at the bottom of the socioeconomic ladder and middle class blacks. Consideration of economic stratification by race and ethnicity includes analysis of wealth disparities and the differences in life chances they create. Structural and cultural explanations of economic outcomes are contrasted. Patterns of economic assimilation shown for recent immigrants are outlined, and the notion of "segmented assimilation" is introduced. Economic interdependence among minority groups receives attention. Extensive recent evidence about employment discrimination is reviewed. The relevance of white Americans' racial attitudes to political opinions and policy outcomes receives attention in readings that focus on policy issues affecting both African Americans and American Indians. Classic and recent frameworks for understanding prejudice and discrimination are introduced. Patterns observed for African American targets are contrasted with those for Latinos and Asian Americans. Research on the outcomes of intergroup contact is reviewed, along with recent "contextual" studies that assess the influence of community characteristics on racial attitudes. Racial/ethnic identity is put in the spotlight, with attention to African Americans but also American Indians, West Indian immigrants, Latinos, Asian Americans, multiracial groups,

and white Americans. "Pan-ethnicity" is considered. The seminar is designed to familiarize graduate students in sociology and related fields with central information about the evolving status of racial and ethnic minority groups in the U.S., and with theoretical perspectives developed in sociology and other social science disciplines to understand racial/ethnic prejudice, discrimination, and inequality.

SOC 530: Sociology of Family

3 Credits

An in-depth introduction to the sociological study of the family. SOC 530 Sociology of Family (3) This seminar will cover critical issues or current debates and issues regarding family policy in the United States. Examples of current family policy debates include welfare, class, gender, etc.

SOC 531: Family Disorganization: Stress Points in the Contemporary Family

3 Credits

Focuses on divorce, remarriage, incest, family violence as well as problems associated with family formation and parent-child relations.

Cross-listed with: HDFS 531

SOC 532: Global Health and Mortality

3 Credits

Major issues in international health from a demographic perspective; special attention to the Global South and to data quality.

Prerequisite: SOC 573

SOC 533: Sociology of Religion Seminar

3 Credits

A survey of the sociology of religion designed to help students conduct and critique social science research.

SOC 534: Childhood and Education in Sociological and International Comparative Perspective

3 Credits

The course objective is to use an international comparative lens and sociological perspective to examine the social, cultural, political and economic forces that shape childhood and the role education plays in this process.

Cross-listed with: CIED 534, EDTHP 534

SOC 537: Biosocial Perspectives on the Family

3 Credits

The implications of knowledge from behavioral endocrinology, behavior genetics, and evolutionary psychology for understanding family relationships and child development. HD FS 537. (SOC 537) Biosocial Perspectives on the Family (3) Breakthroughs in the way biological variables are measured and modeled have generated new findings that greatly increase our understanding of the reciprocal influences between family relationships, child development, and biological factors. Specifically, advances in the study of hormones, genetics, evolution,

pharmacology, and immunology have led to important advances in our knowledge of gender, becoming a parent, early child development, middle child, and adolescent development, parent-child relations, courtship and mate selection, quality of intimate relations, separation and divorce, incest, and dominance and family violence. Students are required to keep a journal of researchable ideas during the first five weeks of class. The purpose is to give students practice in identifying research needs and opportunities. The journal should include 4-6 research problems, each developed in 2-3 typed pages. The majority of each entry should be a clear statement of what knowledge gains would be realized by conducting the study and why they are important. The remainder of the statement should include consideration of the data you would use, measures of major variables, and analytic strategies. Think of it as a brief portfolio of thesis, dissertation, or research publication ideas. Entries on research projects in which you are already involved are not eligible for inclusion in the journal. On the last page of the journal, indicate which problem you would like to develop into a more detailed proposal during the remainder of the semester and why. Turn in the journal during week 5. I will evaluate your entries and comment on your selection idea. The rest of the semester will be spent on developing one of the ideas to a full-blown proposal (about 20 pages). You should turn in as many drafts as needed to receive a good grade for this segment of the course. I expect you to turn in three or more before the end of the semester. We will meet about each draft and go over my comments. Proposal drafts should be spaced out over the semester. The last week of the semester will be devoted to presentations of research proposals after which class members will offer comments and suggestions. Your grade will be based on the proposal draft you turn in the last week of the class. Twenty-one percent of the course grade is based on the research proposal.

Cross-listed with: HDFS 537

SOC 538: Sociology of Education

3 Credits

Provides students with an overview of dominant sociological theoretical perspectives on schools, schooling, and education in modern society. SOC (EDTHP) 538 Sociology of Education (3) This graduate course in the Sociology of Education covers the major sociological theories and empirical research on the role of formal education in society. The object of the course is to have the student become conversant with the main lines of sociological research applied to education and social development at the individual, community, and societal levels. Since sociology of education has had considerable impact on educational policy over the past 50 years, a second goal of the course is to understand this relationship and avenues for future research and policy analysis from a sociological perspective. This course is a central topic in the general study of social stratification and hence in pursuit of the Ph.D. in the Educational Theory and Policy and the Sociology program. The format of the course is a didactic seminar with extensive written assignments as the usual form of evaluation.

Cross-listed with: EDTHP 538

SOC 544: Current Issues in Complex Organizations

3 Credits

Critical survey of recent developments in sociological study of organizations and the theory of bureaucracy, including reciprocal effects on environments.

SOC 550: Cultural Sociology

3 Credits

Cultural sociology is focused on the production, transmission, structure, usage, and implications of social meaning. The course provides tools to conceptualize and understand numerous dimensions of "culture," as well as training in how to study society through a focus on the relation of social meaning to other social processes. The field has numerous theoretical foundations, with much contemporary empirical work being done across sociological subdisciplines. As a result, readings are from an array of sources and may include a wide variety of methods (ethnography, interviews, surveys, social media, big data, and historical). The core questions of the course are: What is culture? How does culture work through different processes? What are the strengths and weaknesses of different theoretical assumptions and methods for the study of culture? The course is structured around ongoing theoretical debates and conceptual tools, using classic and contemporary research examples.

SOC 551: Social Stratification and Social Change

3 Credits

Origin and development of stratification systems and inequality among and within societies; social mobility; change in stratification systems.

SOC 552: Economic Sociology

3 Credits

This course serves as a graduate-level survey of the field of economic sociology. While encompassing a variety of theoretical and methodological orientations, economic sociologists seek broadly to understand the role of social forces in the organization of economic life. As such, theory and research in economic sociology extends, refines, and sometimes critiques complementary perspectives from economics, management, psychology, industrial organization, and other social science fields. The topics emphasized in the course will include the "embeddedness" of economic action in social structure; the role of institutional logics and myths in economic and organizational behavior; structure and change in markets and organizational fields; the role of politics in the economy; how social networks affect economic activity; the role of culture in economic action; patterns of consumption and valuation; trust and uncertainty; and the diffusion of innovations. By the end of the course, students should have a broad understanding of the field of economic sociology and be able to apply knowledge from this field in their own research.

SOC 553: Educational Mobility in Comparative Perspective

3 Credits

Role of education in social mobility, using quantitative, qualitative, and historical methods; focuses comparatively on Britain, East Asia, and South America. CI ED 553/SOC 553/EDTHP 553/HI ED 553 CI ED 553. (SOC 553, EDTHP 553, HI ED 553) Educational Mobility in Comparative Perspective (3) Sociologists interested in higher education have attended to the relationships between postsecondary institutions and other institutions, as well as the impact on higher education of general social and demographic processes. Many of the classical ideas in sociological theory, including those of Max Weber and Emile Durkheim, have surfaced in recent debates over the nature of higher education. Sociologists in the U.S. have explored such questions as: the gatekeeping function of higher education; the impact of universities on stratification; and the socializing environment for women and minorities. This seminar introduces some

of the classical theorists and contemporary researchers of the sociology of higher education. All seminar participants will be required to write a sample research proposal, based on the readings from the seminar.

Cross-listed with: CIED 553, EDTHP 553, HIED 553

SOC 557: Sociology of Higher Education

3 Credits

Reviews theory and current sociology research on student access, achievement, and governance in postsecondary education, with applications to policy analysis. EDTHP (HI ED, SOC) 557 Sociology of Higher Education (3) Sociologists interested in higher education have attended to the relationships between postsecondary institutions and other institutions, as well as the impact on higher education of general social and demographic processes. Many of the classical ideas in sociological theory, including those of Max Weber and Emile Durkheim, have surfaced in recent debates over the nature of higher education. Sociologists in the U.S. have explored such questions as: the gatekeeping function of higher education; the impact of universities on stratification; and the socializing environment for women and minorities. This seminar introduces some of the classical theorists and contemporary researchers of the sociology of higher education. All seminar participants will be required to write a sample research proposal, based on the readings from the seminar.

Prerequisite: graduate students only, except with permission of instructor; EDTHP/SOC 416 is recommended

Cross-listed with: EDTHP 557, HIED 557

SOC 559: Communities and Crime

3 Credits

Crime has been shown to differ significantly across neighborhoods of different racial composition and of different socioeconomic characteristics. Specifically, neighborhoods characterized by high poverty and high segregation are more likely to exhibit higher violence, higher homicide rates, and higher disorder. Moreover, growing up in a highly disadvantaged neighborhood predicts whether youth will be involved in delinquency, risky behavior, and violent crime. In this course, students will learn about the major debates and arguments in the field on how such differences can come about and what may be their consequences. Students will learn to recognize, identify, and apply criminological and sociological theories and thinking on the effects of neighborhoods' social structures on crime. In particular, we will focus on classic and contemporary cutting edge thinking on poverty, social isolation, disorder, collective efficacy, institutional (dis)trust, demographic v. cultural heterogeneity, segregation, immigration, and the physical environment. We will address the theories, methods, and policies related to understanding key features of places such as social (dis)organization, social capital, spatial embeddedness, opportunity infrastructure, and cultural capital.

Cross-listed with: CRIM 559

SOC 560: Urban Sociology

3 Credits

Examination of the structure and dynamics of North American cities and of residents' experiences in such settings. SOC 560 Urban Sociology (3) The major objective of Sociology 560 (formerly 597F) is to survey the field of urban sociology, providing graduate students with a solid grounding in

the literature on North American cities. The course heavily emphasizes recent writings by sociologists. However, the historical development and continuity of the major questions that have guided urban research receive more than passing attention, as do the contributions of geographers, psychologists, and others outside the discipline. A broad range of theoretical perspectives, substantive topics, and methodological strategies are through reading, lecture, and discussion. Students are expected to be active, critical consumers of urban knowledge but also producers of it: they must independently formulate and address a research problem then share their results with their classmates. Once students complete Sociology 560, they should be ready to enroll in more specialized urban seminars and to teach urban sociology at the undergraduate level.

SOC 572: Foundations in Causal Analysis in the Social Sciences

3 Credits

Methods for estimating causal effects in observational data, including matching, counterfactual, and related approaches. SOC 572 Foundations in Causal Analysis in the Social Sciences (3) This course investigates methods for estimating causal effects in observational (non-experimental) data. There are three common strategies for estimating causal effects in observational data. One strategy is to condition on variables to block all the back-door paths from the causal variable to the outcome variable. Examples: matching (including propensity scores) and regression with control variables. A second strategy is to use exogenous variation to isolate the "unconfounded" covariation in the causal and outcome variables. Examples: instrumental variables (IVs), natural experiments, fixed effects. A third strategy is to isolate the mechanisms through which the causal variable operates to affect the outcome variable. These methods are becoming more standard in sociology and related fields. The course will cover the following methods: standard regression and its limitations; natural experiments and instrumental variables; counterfactual or potential outcomes methods; matching methods, including propensity scores; fixed-effects and random-effects; structural equation methods; mixed methods. The course is distinguished from other courses in the university by its focus on the use of statistical methods for causal inference. Whereas other courses describe regression or structural equation models as general methods for one's statistical toolkit, this course concentrates on when, and how, regression or structural equation approaches can be used to draw causal inferences from non-experimental data. Examples will be drawn from a variety of social science disciplines, including economics, political science, and criminology, as well as from sociology.

SOC 573: Demographic Techniques

3 Credits

Models and measures of vital processes (fertility, mortality, migration) and their effects on growth and age structure of human populations.

Prerequisite: STAT 200

SOC 574: Statistical Methods for Social Research

3 Credits

Basic concepts of statistics; linear regression; computer software; analysis of social surveys; causal inferences from nonexperimental data.

Prerequisite: 3 credits in statistics and 3 credits in research methods.

SOC 575: Statistical Models for Nonexperimental Research

3 Credits

Causal models for quantitative and qualitative data; path analysis and structural equations; logistic regression; duration models.

Prerequisite: SOC 574

SOC 576: Applied Mathematical Demography

3 Credits

Survey of mathematical models used in the study of population: models of growth, survivorship, fertility, migration, stability, kinship, projection.

Prerequisite: ANTH 408 or SOC 473 ; calculus

SOC 577: Techniques of Event History Modeling

3 Credits

Survival analysis theory and methods for discrete dependent variables.

Prerequisite: SOC 575

SOC 578: Multilevel Regression Models

3 Credits

Covers multilevel regression models for the analysis of nested or hierarchical data, including both contextual and longitudinal applications. SOC 578 Multilevel Regression Models (3) This course is devoted to statistical models for regression analysis of multilevel data. Multilevel data arise when cases are sampled at two or more levels, with each lower level subsumed within the next higher, such as residents within neighborhoods within cities or individuals within families. Such data almost always violate the independence assumption of ordinary least squares regression, and in recent years a wealth of more appropriate techniques have become available. These methods bring the full flexibility of multiple regression analysis to the analysis of multilevel data, enabling scholars to address a broad range of research questions. This course thoroughly covers the basic multilevel regression model and also devotes considerable time to more advanced topics such as analysis of data with three or more levels, multilevel analysis of discrete dependent variables, and latent variables. Students will study examples in a broad range of substantive domains, with special attention to the unique research questions to which these methods give access. This is a course in the application of statistics to social science research, not a theoretical statistics course. Therefore the course will not include derivations and proofs, but rather the mathematics covered will be in the service of defining statistical models that correspond to useful research questions. The emphasis will be on understanding how to use these methods to do good research and on learning to interpret the results they provide. Several class sessions will be held in computer laboratories in order to train students in the use of statistical software that implements these methods.

Prerequisite: SOC 575

SOC 579: Spatial Demography

3 Credits

This graduate course will expose students to spatial analysis tools and analytical methods applied to demographic research. ANTH (SOC) 579 Spatial Demography (3)The improved application of spatial data

and methods to demographic research is a critical methodological challenge facing demographers today. This graduate seminar is designed to focus on substantive demographic research topics while exposing sociologists and demographers to challenges in, and opportunities for, using geographic information systems (GIS), spatial analysis, and spatial statistics in their own research. Substantive foci will include readings and discussions of spatial perspectives on topics such as racial/ethnic segregation, spatial mismatch/entrapment, poverty, crime/delinquency, migration, health inequalities, wellbeing, maternal and child health, environmental justice, and population and environment relations. Similarly, the seminar will highlight connections between spatial concepts and data availability (e.g., Modifiable Areal Unit Problem - MAUP; data privacy), other emerging methodological approaches to studying society (e.g., contextual modeling, multi-level modeling and the area of neighborhood effects) as well as the integration of different types of data (e.g. qualitative data and quantitative data). Throughout the course lectures and discussions will be complemented with lab sessions introducing spatial analysis methods and GIS and spatial analysis software. The lab sessions will include the use of among other software GeoDa, CrimeStat, R, and ArcGIS (including Geostatistical Analyst and Spatial Analyst extensions). These lab sessions will introduce many methodological and technical issues relevant to spatial analysis (e.g., error, data validation, data integration, cartography, exploratory spatial data analysis, spatial regression modeling, geographically weighted regression, point pattern analysis and geostatistics). Assignments for the courses include up to two writing assignments, up to four lab assignments, and a final project which will be presented as a short 15-minute presentation as well as submitted as a term paper. The writing assignments will include an annotated bibliography/brief literature review within a selected demographic theme area and a profile of a well-known demographer and their adoption of spatial thinking/perspectives/methods. The lab assignments will focus on building geospatial databases, basic spatial analysis, exploratory spatial data analysis, and spatial regression modeling. The courses will include other labs and assignments that will be completed for no grade; these are intended as mechanisms/opportunities for developing and enhancing familiarity with selected software, data resources, and analytic methods.

Prerequisite: Graduate course in statistics, i.e., SOC 574 or ANTH 509
Cross-listed with: ANTH 579

SOC 580: Social Network Analysis

3 Credits

Methods of social network analysis used to examine patterns of ties among actors in a social system. This course provides an overview of the analytic methods and conceptual perspective of a social network approach to social science research, with a focus on quantitative methods. Social network analysis is used to examine patterns of ties between multiple actors in a social system, where the actors could be individuals, dyads, groups, organizations, or nation-states. There has been a dramatic rise in the application of such an approach to research from a broad range of researchers over the past decade. A social network approach is applicable to several subfields within sociology, such as social psychology, demography, criminology, organizations, and the family. The course objectives are to: 1) become familiar with the basic elements of social network analysis and recognize situations where this approach may be useful; 2) develop an appreciation for the conceptual perspectives behind this modeling approach; 3) learn about the strengths and limitations of network models and analyses; 4) apply social network analysis to empirical data and interpret findings, and finally: 5) complete a research paper that applies this approach to data regarding a social

science problem. Network topics covered include centrality, clustering and cliques, triads and transitivity, weak ties, structural equivalence, and network visualization. In addition, students will be introduced to advanced topics, such as exponential random graph models, and dynamic SIENA models. Students should have completed two semesters of social statistics at the graduate level or equivalent before enrolling in this course.

SOC 584: Attitude Formation and Change

3 Credits

Theory and method in research on attitude formation and change with emphasis on critical analysis.

Prerequisite: PSYCH420 or SOC 403 ; 3 credits in statistics

Cross-listed with: PSY 584

SOC 591: Teaching Sociology/Criminology

1 Credits

Preparation for teaching sociology and/or criminology at the college level. CRIM (SOC) 591 Teaching Sociology/Criminology (1) Preparation for teaching sociology and/or criminology at the college level.

Cross-listed with: CRIM 591

SOC 592: Writing for Publication in the Social Sciences

3 Credits

Systematic, collective review of unpublished student manuscripts with an eye toward revision for publication. SOC 592 Writing for Publication in the Social Sciences (3) The overarching goal of the course is to prepare relatively advanced Ph.D. students to write effective journal articles, books, and grant proposals. The course emphasizes learning by doing. We begin by writing reviews of anonymous manuscripts that have been submitted to journals for possible publication. We ask four key questions about each article: What do we like about the manuscript (strengths)? What do we dislike (weaknesses)? What suggestions do we have - substantive and stylistic - for revising the manuscript? Is it published? Class discussion is organized around those questions. Then we use the same format and tools to critique unpublished student manuscripts. We discuss each manuscript with a view to answering the question of how the manuscript needs to be revised to make it publishable. Finally we read key articles on the differences between journal writing, book writing, and the writing of grant proposals. Again students are given hands-on experience by reviewing book prospectuses and grant proposals. The course is designed to be a core course in the Sociology Department's Professional Development Module for Ph.D. students. The specific goals of the course are: A publishable paper - or at least concrete suggestions for how to make a student manuscript publishable, or book precis competitive, grant proposal fundable. A better understanding of how the review process works - what happens after you submit your paper, precis, or research proposal; what to expect from the editor's decision letter. A better understanding of what editors and reviewers are looking for in a journal manuscript, book precis, or grant proposal, and a better understanding of how to respond to reviewers' criticisms when you are invited to resubmit a manuscript or grant proposal. Good reviewing skills - what a good review looks like, and how to go about writing one. An expansion of students' intellectual horizons through exposure to different substantive areas, methodologies, and styles of work. Students will be evaluated on the basis of their written reviews due each week. The course will be offered at least twice every three years. Course enrollment should

be limited to 12, to enable full in-class discussion of each student's manuscript.

Prerequisite: Master's thesis or permission of program

SOC 595: Internship in Political Science

1-9 Credits/Maximum of 9

Supervised off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

Prerequisite: Prior consent of supervisor, advisor, or department head; applicable departmental internship requirements such as satisfactory completion of required upper level courses appropriate for the internship program selected.

Cross-listed with: PLSC 595

SOC 595A: Survey Research Practicum

1-6 Credits/Maximum of 6

Practicum in Survey Research data collection or management.

Prerequisite: PL SC518 or SOC 518 and PL SC519 or SOC 519

Cross-Listed

SOC 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

SOC 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

SOC 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

SOC 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

SOC 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Students will teach introductory level courses as required by staffing and students' needs.

SOC 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

Software Engineering (SWENG)

SWENG 510: Secure Software Engineering

3 Credits

This course provides a foundation in software engineering techniques for developing secure software systems.

SWENG 541: Advanced Database Design Concepts

3 Credits

Practical benefits of a Database Management System; three-stage process to create and implement a relational database to meet defined requirements.

Prerequisite: IN SC521 or approval of instructor or department

SWENG 568: Enterprise Integration

3 Credits

Advances in design, development, and deployment of control and management software for enterprise and production information systems.

SWENG 569: Service Oriented Architecture

3 Credits

The principles of service oriented architecture; modeling, design and implementation of services; mapping business processes to services. SWENG 569 Service Oriented Architecture (3) Service-Oriented Architecture (SOA) is a design principle for guiding the design, development, deployment, and sustaining of flexible and agile IT solutions. SOA has become increasingly viable because of the widespread adoption of Web services technology that makes creating SOA practical and cost effective. SOA essentially makes IT agile, interoperable, and more responsive. This course is structured to be appropriate for graduate students in software or systems engineering, or information science. Many of the topics covered in this course may be applied to a wide variety of research areas. Usually this course would cover the following topics: 1) Model, design, and implement SOA; 2) Create agile and reusable SOA; 3) Automate business processes by mapping to the architectural model; 4) Orchestrate services and execute processes with the Business Process Execution Language (BPEL); 5) Achieve interoperability within SOA using proven design patterns and/or best practices; and 6) Implement loosely coupled services using WSDL-first techniques. Students will be evaluated on their understanding of the course material by completing one examination (20%), weekly assignments (40%), and an individual project with presentation (40%).

SWENG 580: Advanced Software Engineering

3 Credits

Description of tools and techniques in the software development lifecycle; Mitigation and managing time-to-market and quality of large software systems.

Prerequisite: SWENG537 or equivalent knowledge with instructor's permission

SWENG 581: Software Testing

3 Credits

This course provides a rigorous formal framework and practical information on this the testing of software throughout its life cycle. SWENG 581 Software Testing (3) This course provides a rigorous formal framework and practical information on the testing of software throughout its life cycle. Emphasis will be placed on software testing activities throughout the software lifecycle, testing of object-oriented and non-object-oriented software, and on formal methodologies for software testing. Documentation of software testing activities will also be covered.

Prerequisite: SWENG537 or instructor's permission

SWENG 582: Real-Time Software Design and Analysis

3 Credits

A holistic, systems-based approach to design and analysis of real-time systems; design and implementation of a small real-time system.

Prerequisite: completion of all IN SC or SWENG core courses or with instructor or division approval

SWENG 584: Genetic Algorithms

3 Credits

Application of genetic algorithms to problems in engineering and science including combinatorial optimization, multi-criteria optimization, biology, chemistry, and neural networks.

Prerequisite: completion of a course in data structures and algorithms, or on approval of department

SWENG 585: Pattern Oriented Design

3 Credits

This class examines well-known heuristics, principles and patterns in the design and construction of reusable frameworks, packages and components. SWENG 585 Pattern Oriented Design (3) This course studies the heuristics, principles and patterns of object-oriented design in the construction of extendable frameworks, reusable packages and pluggable components. Topics covered include Riel's object-oriented design heuristics, Martin's principles of class and package design, the "Gang of Four" design pattern catalog, refactoring and framework evolution.

Prerequisite: SWENG537

SWENG 586: Requirements Engineering

3 Credits

Theory and applications of requirements elicitation, analysis, modeling, validation, testing, and writing for hardware and software systems. SWENG 586 Requirements Engineering (3) This course is a thorough treatment of the theoretical and practical aspects of discovering, analyzing, modeling, validating, testing and writing requirements for systems of all kinds, with an intentional focus on software-intensive systems. The course will bring to bear a variety of formal methods, social models, and modern requirements writing tools (e.g., the UML) to be useful to the theorist and practicing engineer. Students will be led through a series of weekly activities that culminate in the delivery of a complete software requirements specification project for a hardware/

software system (first in draft, then in final form). The project is broken down into four subprojects, Requirements Elicitation, Requirements Analysis and Representation, Requirements Validation and Testing, and Final Requirements Documentation, each of which counts 25% toward the final grade. The course can be used as an elective in the Master of Software Engineering (M SE) program and, it is a required course in the online Systems Engineering (M.Eng.) program.

SWENG 588: Program Understanding

3 Credits

Techniques for the analysis and visualization of large software systems to assess the quality of the design and architecture. SWENG 588 Program Understanding (3) It is a general observation that software engineers learn about software design, programming languages, paradigms, patterns and tools, and are expected to produce high quality designs and code, often without ever having seen good examples. This approach is akin to teaching students the syntax of the English language and writing techniques and then expecting them to become expert writers without ever having read great literary works. The course in Program Understanding seeks to educate graduate software engineering students beyond their understanding of code syntax and best construction practices with analytical evaluation of "great works" of software code. This approach includes manual code reading, the use of visualization techniques, and automated approaches to assessment of design and code quality.

SWENG 594: Research Topics

1-15 Credits/Maximum of 15

Supervised student activities on research projects identified on an individual or small-group basis.

SWENG 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

SWENG 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

SWENG 805: Software Project Management

3 Credits

Analysis and construction of project plans for the development of complex software products; how to manage change and cost control.

SWENG 826: Applied Human-Computer Interaction

3 Credits

Evaluate and design interactive products that support how people work and communicate from both a theoretical and practical perspective. SWENG 826 Applied Human-Computer Interaction (3) This course introduces the student to the broad area of human-computer interaction. Emphasis is placed on applying theories and techniques to the evaluation and design of software-based products that are both useful and usable.

Students will gain an understanding of these concepts primarily by analyzing existing interfaces and developing prototypes. Students will be exposed to the challenges of usability testing through review of published studies and by developing a usability study design. Objectives: The course objectives are for Information Science professionals and software engineers to: 1. Identify examples of positive and negative user experiences in both everyday life and the work environment 2. Gain an overview of HCI theories, principles, and guidelines 3. Learn how to design for usability 4. Learn how to incorporate usability design into the software development process 5. Use usability principles to evaluate and compare software-based products 6. Learn how to effectively test for usability Performance will be evaluated through projects where students will apply what they have learned to design and evaluation problems. It is anticipated that this course will be offered once every year with expected enrollment of 20 students per offering.

SWENG 837: Software System Design

3 Credits

The application of engineering best practices to the requirements, analysis and design of large software-centric systems will be presented. This will include the state of the art in software modeling techniques, the Unified Modeling Language and the Unified Process, along with tried and tested structured approaches. Students will learn how to analyze customer requirements and then systematically develop complete software specifications to meet those requirements using appropriate techniques for the application domain.

Prerequisite: CMPSC483W or equivalent knowledge with instructor's permission

SWENG 861: Software Construction

3 Credits

Students will learn and practice the elements of constructing a large-scale distributed software system using current technologies. SWENG 861 Software Construction (3) This course will expose the student to the elements and activities of software construction with a particular emphasis in the development of large-scale distributed software systems. Through investigation of large-scale distributed applications, the student will have the knowledge to be much more productive at modern software development. This course will begin by covering the foundation that surrounds large scale software construction such as performance, scalability, fault-tolerance, and security. Following the foundation, a particular emphasis in this course is on technologies that are used to build applications for modern devices and systems as well an emphasis on overcoming the issues that large-scale distributed systems encounter such as security and availability. The student will also investigate web services that help with the interoperability across heterogeneous platforms as well as learn how to handle concurrency, persistence and unit testing across all tiers of the application. Finally, the students will learn how to deal with deployment and security in large-scale distributed systems. Students will learn and practice software construction by developing a project that evolves gracefully as the technology discussion evolves but will have the freedom to work on either Java EE or MS. NET platforms.

SWENG 887: Software Systems Architecture

3 Credits

Architecture is an abstract view of a software system distinct from the details of how such a system is implemented. A robust architecture is key to developing software systems that meet quality expectations (such as performance, scalability, availability, maintainability, etc.) of their stakeholders. This course introduces basic concepts of software architecture, architectural design principles, and patterns. Students also learn how to document and evaluate software architectures, and reuse architectural assets through software product lines. This course is structured to be appropriate for graduate students in software or systems engineering. Many of the topics covered in this course may be applied to a wide variety of research areas. Students will be evaluated on their understanding of the course material by completing one examination (25%), weekly assignments (35%), and an individual project with presentation (40%).

SWENG 888: Mobile Computing and Applications

3 Credits

design and development of mobile computing-based applications and services utilizing current and emerging mobile computing technologies. The purpose of this course is to provide students with an advanced and hands-on exploration of mobile computing paradigms. Mobile computing addresses the mobility needs of business operations and management in organizations, with the increasing trend of leveraging a variety of deployed enterprise information systems. Hence, well-designed and developed mobile applications can meet the needs of business mobility on both the service provider and the customer sides. This course is designed to explore and discuss approaches to the design and development of mobile applications. It builds an awareness of the business need for operational agility and mobility, and the value of existing IT investments in organizations. Specifically, this course investigates the fundamental design and development of mobile applications and services using platform technologies; area topics include mobile application and services design patterns, user interface, animation, location & mapping, and integration. Through working on exercises, labs, and projects, students will be able to identify and apply appropriate mobile platform technologies in their assignments and will gain skills and coding experience in the development of adaptable and sustainable mobile application solutions. Consequently, with this course, students will learn mobile development environments, application and service design and development, device emulators, data and mobility management, and enterprise solution-based integration. Cross Listings: IST 888 will be added as a cross-listed course.

Cross-listed with: IST 888

SWENG 894: Capstone Experience

1-18 Credits/Maximum of 18

Supervised, professionally oriented student activities that constitute the culminating experience for the program.

Soil Science (SOILS)

SOILS 502: Soils Properties and Functions

3 Credits

Introduction to soil science for graduate students including fundamentals of and applications to plant production and environmental sustainability. SOILS 502 Soils Properties and Functions (3) This course provides an introduction to soil science, emphasizing the three areas of biological, chemical and physical properties of soils. It is intended as an introductory course in soil science for graduate students whose work would benefit from background knowledge of soil science but who have not previously been exposed to the science of soils as an undergraduate. As a graduate course, the pace of learning will be rapid, and the material covered will be quite comprehensive. The breadth of material is comparable to that covered in an undergraduate introduction to soil science, but with greater depth. The class will incorporate a substantial level of experiential components, including chemical analysis lab practice overview, some labs for gaining insight into physical properties, and field trips to help students gain an appreciation of how soils are influenced by, and also influence, the landscape in which they exist. Landscape visits with guided discussions, research proposal development and analysis, and selected soil management problem analysis provide students opportunities to synthesize classroom and textbook based material. Students will be evaluated based on quizzes, exams and written assignments.

SOILS 504: Unsaturated Zone Hydrology and Chemical Transport

3 Credits

Recommended Preparations: At least one undergraduate course in Mathematics and in Chemistry. GEOSC 452 This course provides the theoretical basis for and mathematical description of the transport of water and chemicals through the unsaturated zone between the soil surface and the regional water table. This zone is frequently referred to as the vadose zone. In particular, the course investigates the solutions to problems involving the transport of water and chemicals through the vadose zone, such as might be the case when attempting to predict direction and rate of a contaminant spill, or to determine the length of time required for contaminant remediation, or to protect buried waste from infiltrating water. Students will recognize parameters required in order to develop solutions to identified problems, will identify means to obtain values of the needed parameters, and will develop model solutions in order to gain insight into expected outcomes of proposed solutions.

SOILS 507: Soil Physics

3-4 Credits/Maximum of 4

Soil physical properties emphasizing water, heat, gas, and ion movement in unsaturated soils. Laboratory included with 4 credits.

Prerequisite: 6 credits each of calculus, physics, and soils

SOILS 510: Geographic Information System Applications

3 Credits

Soil data bases, image processing, and geographic information systems will be used to model and understand land and water resources.

Prerequisite: GEOG 457

SOILS 512: Environmental Soil Microbiology

3 Credits

Biology and ecology of microorganisms in terrestrial environments; microbiological and molecular analysis methods; microbial processes in carbon and nitrogen cycling. SOILS 512 Environmental Soil Microbiology (3) Environmental Soil Microbiology (SOILS 512) examines the major groups of microorganisms and their processes and interactions in terrestrial systems, with an emphasis on carbon and nitrogen cycling. Students will obtain an overview of the biology, ecology, and functions of bacteria, archaea, and fungi in soils, rhizospheres, sediments, and organic wastes. This course is intended for students interested in spatial and temporal distribution and activities of microorganisms in the environment, as well as in appropriate methods for analyzing microbes in environmental samples. Course format will consist of two weekly lectures, each followed by a 25 -min discussion period. Class discussions will include exercises and reviews of recent literature on classical and molecular soil/environmental microbiology. Grading will be based on participation in class discussions (20%), two midterm exams (20 % each), one final take-home exam (20%), and a 10-page research proposal to be presented to the class in late April (20%). SOILS 512 will support interdisciplinary training of graduate students in Soil Science as well as in other disciplines of the College of Agricultural Sciences, especially Plant Pathology, Horticulture, Entomology, and Agricultural and Biological Engineering. Graduate students in the Intercollege Graduate Degree Program in Ecology (IGDPE), College of Earth and Mineral Sciences, Eberly College of Science, and College of Engineering also will find this course useful when undertaking research on systems involving microorganisms (e.g., biogeochemistry, plant or animal systems, or environmental engineering). Course will be offered every other spring semester with an anticipated enrollment of 20 students per class.

Prerequisite: two years of chemistry and B M B401 , A B E308 , or equivalent

SOILS 513: Soil Environmental Chemistry

3 Credits

Chemical constituents and processes occurring in soils. Discussion of soil components, reactions at the solid-solution interface, and soil chemical processes.

Prerequisite: CHEM 450

SOILS 516: Soil Genesis

1-4 Credits/Maximum of 4

Field trip to study the genesis, classification, and geomorphology of the major soils of the northeastern United States.

Prerequisite: SOILS416 or 6 credits in geology or physical geography

SOILS 519: Nature of Soil Minerals

3 Credits

Constituent minerals of soils: modern methods for identification; relations to soil formation and agricultural practices.

SOILS 536: Topics in Biogeochemistry

2 Credits/Maximum of 999

This seminar addresses chemical interactions between the biosphere and the physical environment over Earth's history and as impacted by humans. This course will provide a broad survey of biogeochemical principles, and offer a community-building experience for students with biogeochemical interests from diverse departments. Students will complete the course with a synthetic knowledge of the key topics in the field of biogeochemistry. Each week we will focus on a topic within the broad field of biogeochemistry such as: origins of the elements, reactions in the atmosphere, soil development, the distribution of redox reactions and microbial metabolic pathways, and the global cycles of carbon, water, nitrogen, phosphorus, sulfur, mercury, and perhaps other elements. For each topic, we will focus on the questions: What is known or can be observed? How is this information used to understand biogeochemical phenomena and process? How are these processes scaled over time and space? What are emerging and important questions in the subspecialties of biogeochemistry?

Cross-listed with: CE 536, GEOSC 536

SOILS 571: Ecosystem Nutrient Cycles

3 Credits

Ecological theory and applications related to water, carbon, nitrogen, phosphorus, and cation cycling in managed and unmanaged terrestrial ecosystems. SOILS 571 Ecosystem Nutrient Cycles (3) This course is designed to benefit basic and applied environmental scientists that want to understand how nutrients cycle in terrestrial ecosystems. Students will develop knowledge of the biologically important nutrient cycles in terrestrial ecosystems, including linkages between nutrient cycling and energy (carbon) and water flow. The material covers the major theoretical advances in ecosystem ecology and applications of ecosystem theory to environmental management and problem solving. The water, carbon, nitrogen, phosphorus, and nutrient cation cycles will be covered. For each nutrient, inputs, outputs and internal cycling in plants and soils are discussed. Class time will include a mixture of lectures, discussions of primary literature and case studies, and group projects. Each student will write a paper on a topic related to their research that will be reviewed by student peers. Field and laboratory experiences will expose students to methods used by ecosystem ecologists. Students will complete the class with an understanding of: (1) classic and contemporary theories of nutrient cycling at the ecosystem scale, 2) variability in nutrient cycling among the major unmanaged and managed ecosystem types, 3) ecosystem responses to natural disturbance and human management, and 4) common and cutting-edge methods of ecosystem analysis.

SOILS 589: Critical Zone Science Seminar

1-3 Credits/Maximum of 3

This course will explore the foundations, discoveries, and applications linked to the Critical Zone concept through primary literature, class discussions, and original student projects. We will start by spending one week each on the four foundational science domains that are woven together to make Critical Zone science: hydrology, geoscience, soil science, and ecology. Then we will spend several weeks highlighting key discoveries that arise from the interdisciplinary Critical Zone perspective. The end of the class explores whether the Critical Zone science perspective might have useful applications for land and water management. Throughout the class, students take a co-leadership

role with the instructors in terms of selecting readings, lecturing, and designing active learning allied with key concepts.

Cross-listed with: CE 589, GEOSC 589

SOILS 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

Cross-listed with: FOR 590, WFS 590

SOILS 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

SOILS 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

SOILS 600: Thesis Research

1-15 Credits/Maximum of 999

NO DESCRIPTION.

SOILS 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

NO DESCRIPTION.

SOILS 602: Supervised Experience In College Teaching

1-3 Credits/Maximum of 6

GRADUATE STUDENT INVOLVEMENT IN PREPARATION, PRESENTATION, AND EVALUATION OF COURSE MATERIALS FOR UNDERGRADUATE FORMAL COURSES.

SOILS 610: Thesis Research Off-Campus

1-15 Credits/Maximum of 999

No description.

SOILS 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

NO DESCRIPTION.

SOILS 804: Soil Ecosystem Analytical Techniques

3 Credits

SOILS 804 is a three-credit quantitative laboratory instrumentation course that is designed to give students a deeper understanding and application of modern laboratory instrumental techniques for the isolation, identification, detection, and quantitation of soil ecosystem chemical substances. Upon completion of the course, students should be well versed in appropriate techniques used to collect and process a

sample and measure the chemical constituents and assess the condition of soil ecosystems: soil gases; soil inorganic and organic solids, and soil solutions/digests/extracts. Instrumental techniques covered in the course include spectroscopic, chromatographic, spectrometric, electrochemical, and thermal methods for soil ecosystem measurements. As such, the course has laboratory and lecture components. In the lectures, students learn good laboratory practices, sampling and sample processing and preparation methods, selection of analytical instruments and the chemical and/or physical principles exploited during the measurement, how the instrument performs the measurement and some of the techniques used to increase accuracy, precision, sensitivity, selectivity, and measurability. In the laboratory, students will put the theory and principles into practice by performing various analytical experiments designed to provide examples of the usefulness of selected instruments or techniques in a way that will enable the student to understand and operate a wide range of other related instruments for soil ecosystem analyses. Thus, while the laboratory experiments and demonstrations will illustrate some of the applications of the instruments, students will be expected to develop a deep understanding of the advantages and disadvantages of different instrument analytical techniques in terms of their usability, sensitivity, cost, and other parameters with emphasis on the applicability and complementarity of different techniques to soil ecosystem chemical measurements.

SOILS 896: Individual Studies

1-9 Credits/Maximum of 9

Creative projects with a professional orientation, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

SOILS 897: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject with a professional orientation that may be offered infrequently; several different topics may be taught in one year or semester.

Spanish (SPAN)

SPAN 502: Theory and Techniques of Teaching Spanish

1-3 Credits

Audio-lingual orientation.

SPAN 507: Hispano-Romance Linguistics

3 Credits/Maximum of 9

History, development, and linguistic description of Old Spanish and related Romance languages of the Iberian Peninsula.

SPAN 508: Generative Syntax

3 Credits

This course offers foundations of generative syntax. It addresses the advantage of a scientific model to explain human knowledge of language that also makes predictions about its representation in the mind.

SPAN 509: Functional Syntax

3 Credits

This course covers foundations of functional syntax. It addresses the advantages of a scientific approach to explain human knowledge of language that makes predictions about its representation in the mind.

SPAN 510: Spanish Descriptive Linguistics: Phonology

3 Credits

No description.

SPAN 513: Acquisition of Spanish as a Second Language

3 Credits

Analysis of research on the acquisition of syntax, phonology, lexicon, discourse. SPAN 513 Acquisition of Spanish as a Second Language (3) An in-depth analysis of current research carried out on the acquisition of Spanish as a second language. Focus will be on syntax, phonology, lexicon, discourse, and pragmatics. Specific topics covered include the following: null-subjects, clitics; movement and word order, tense and aspect, mood, agreement features, grammaticalization, modality, negation, functional categories, tutored vs. untutored learners, UG vs. non-UG effects, the Noun Phrase Accessibility Hierarchy, markedness, cohesive devices, speech acts, metaphors, idioms, the lexicon and culture, the phonological systems, including suprasegmentals. In addition to developing an understanding of the current research on the acquisition of Spanish as a second language, students will learn how to read the research literature from a critical perspective and how to read empirical data presented in published research that might result in alternative interpretations from those espoused by authors of published work. This goal will be achieved in two ways: requiring students to submit via e-mail to the professor and other students in the seminar two- to three-page critiques of assigned readings; and oral presentations in class of readings selected by the student(s). Some of the critical reports and presentations will be carried out jointly, and others will be done individually. Students will also learn how to design and implement empirical research on the acquisition of Spanish as well as how to write up the results of this research in a potentially publishable research report. Finally, they will have the opportunity to present their research findings to the Penn State applied linguistics community, in a mini in-house workshop at the end of the course. In preparation for this, time will be set aside near the end of the seminar for students to present and discuss their research with their colleagues in the course. Most of the readings for the course will be preselected by the professor; however, students will also be expected to carry out independent reading of publications not included in the course syllabus and present and critique what they read in the seminar.

Prerequisite: introduction to Hispanic linguistics

SPAN 514: Hispanic Dialectology

3 Credits/Maximum of 6

Early fragmentation among the peninsular dialects; their status today, Judeo-Spanish; descriptive analysis of modern Spanish American dialects.

SPAN 519: Current Statistical Practice in Language Science

3 Credits

Our primary goal in this course is to explore how to analyze and interpret quantitative data in language science. Part of this goal will be to gain familiarity and proficiency with a range of quantitative techniques common in language science. Reflecting trends in the field, linear and logistic mixed effects regression will be a major focus in addition to more well-known (e.g. ANOVA, multiple regression, chi-square) techniques. We will also spend some time exploring other methods such as multidimensional scaling, generalized additive modeling, and conditional inference trees, as well as more specialized techniques (e.g. drift-diffusion modeling). A more important goal is to learn to think critically about quantitative data and how we can learn from it. This includes a critical view of quantitative research in general, questions of measurement, the many decisions involved in analytic strategy, model structure and interpretation, and the ability to extend students' knowledge to new techniques independently.

RECOMMENDED PREPARATION: Completion of an introductory graduate level course in statistics, or advanced undergraduate courses. Experience with regression and familiarity with common software for statistical analysis in language science.

Cross-listed with: LING 519

SPAN 528: Seventeenth-Century Spanish Literature

3 Credits/Maximum of 9

Prose and poetry of major authors: works and trends of the late Golden Age and Baroque period.

SPAN 537: Golden Age Theatre

3 Credits/Maximum of 6

Major works of Lope de Vega, Tirso de Molina, Calderon, and others.

SPAN 561: The Cinematic Pluriverse of Pedro Almodóvar

3 Credits

This seminar will examine the cinematic imagination of Spain's most internationally celebrated filmmaker, Pedro Almodóvar. Topics to be considered will include Almodóvar's lensing of gender politics, sexuality, multiculturalism, and national identity in post-dictatorial Spain; his nimble negotiation of the local and the global; his taste for cinephilic self-referentiality and hybridity of genre; and a distinctive tendency toward thematic idiosyncrasy all of which are signature features of his postmodern 'brand.' Significant attention will be devoted to approaches and trends within the vast corpus of scholarly criticism dealing with the filmmaker's oeuvre, and our engagement with film theory will arise organically out of the references from these texts. Some basic tools, techniques, and language of film analysis will be considered, as will a general understanding of field-specific norms of film studies as practiced in North American and U.K. Hispanism.

SPAN 566: Contemporary Spanish Poetry

3 Credits

Various currents in Spanish poetry from the generation of 1927: Lorca, Aleixandre, Salinas, Guillen, Alonso, Alberti, Hernandez, Otero, and others.

SPAN 568: Early Spanish American Literature

3 Credits/Maximum of 9

Content varies; selected topics from colonial period, romanticism, and the nineteenth century before modernism.

SPAN 571: Latina/o Studies: Foundations in the Field and Its Teaching

3 Credits

A foundation in the field and strategies for teaching Latina/o Studies to undergraduates. This course provides a foundation in U.S. Latina/o Studies Literature and its contexts, with two separate but related goals. The first is to get a grasp on the U.S. Latina/o Studies canon that integrates humanities and social science approaches in order to analyze critical historical contexts that have shaped the emergence and evolution of the field of Latina/o Studies in U.S. higher education and academia, such as early colonial enterprises in the South and the Southwest, Spanish and U.S. imperialism, the Chicano and Young Lords movements during the 1960s, immigration patterns from the Caribbean and Latin America, government policies towards Latinos, contemporary rural and urban movements, etc. The second goal is to explore systematically pedagogical theories and practices in Latina/o Studies and critical race scholarship more broadly, in order for students to become conversant in the theoretical debates that underlie the design of curriculum and classroom practice in Latina/o Studies at the undergraduate level. The course will incorporate some of the major lines of research in Latina/o Studies from different disciplines (such as History, Anthropology, Ethnic Studies, Gender and Sexuality Studies, and Linguistics) in order to address some of their most relevant discussions, internal critical debates, and major schools of thought. Students will also engage with other forms of cultural production, including visual culture, theater and performance, and music, among others. The seminar will provide graduate students a solid foundation in the development of a very timely and marketable research and teaching minor.

Cross-listed with: LTNST 571

SPAN 572: Translation in the Americas

3 Credits

This course provides a broad exploration of translation in the Americas. In particular, it investigates the politics, practices, and theories of translation in Latin America and the United States from the late nineteenth century to the early twenty-first century, which allows for a comparative mode of reading across and between borders of language, nation, and region. The following questions will guide our readings and discussions over the course of the semester: How does translation unfold as a metaphor, a linguistic act, and a cultural experience in the Americas? To what extent do processes of translation inform the exchanges of languages, peoples, and cultures within and between nations in this region? The class examines the role of canonical Latin American writers as translators and scholars in order to underscore the centrality of translation to the production, circulation, and reception of Latin American literature. The course analyzes the contributions of Latin American writers, including José Martí, Brazilian modernists, Jorge Luis Borges, concrete poets Augusto and Haroldo de Campos, Octavio Paz, and Julio Cortázar, to discussions of translation by reading their works on translation as theory and practice alongside key essays in translation studies by, among others, Walter Benjamin, Jacques Derrida, Gayatri Spivak, Lawrence Venuti, and Emily Apter. It also considers the importance of translators like Gregory Rabassa, Suzanne Jill Levine,

and Elizabeth Bishop in disseminating Latin American literature within the United States. Building on these insights, students will consider the recent phenomenon of Latin American literature in translation and re-translation to recognize translation as a linguistic and aesthetic challenge governed by, in part, the political and economic demands of the global, literary market.

SPAN 587: Stylistic and Literary Criticism

3 Credits

Major theories of literary criticism applied to Hispanic literature.

SPAN 589: Technology in Foreign Language Education: An Overview

3 Credits

Approaches to the uses and research applications of multimedia and other educational technologies applied to the teaching of foreign languages. (also crosslisted with SPAN 589)

Cross-listed with: APLNG 589, CMLIT 589, FR 589, GER 589

SPAN 596: Individual Studies

1-9 Credits/Maximum of 9

CREATIVE PROJECTS, INCLUDING NONTHESIS RESEARCH, WHICH ARE SUPERVISED ON AN INDIVIDUAL BASIS AND WHICH FALL OUTSIDE THE SCOPE OF FORMAL COURSES.

SPAN 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

SPAN 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

SPAN 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

SPAN 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Supervised experience in teaching and orientation to other selected aspects of the profession at The Pennsylvania State University.

SPAN 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

Special Education (SPLED)

SPLED 500: Seminar in Special Education

1-9 Credits/Maximum of 9

Continuing series of professional seminars designed to provide a forum for discussion of current and classical research concerning exceptional children.

Prerequisite: EDPSY400 ; 6 credits in special education

SPLED 501: Administration and Supervision of Educational Programs for Exceptional Children

3 Credits

Problems connected with the instituting and organizing of classes for atypical children; the legal phases, finances, teaching personnel, pupil personnel, housing, equipment, courses of study, curriculum, etc.

Prerequisite: SPLED401 and EDLDR480 , or teaching or administrative or supervisory experience

SPLED 502: Educating Individuals with Autism Spectrum Disorders

3 Credits

This seminar addresses evidence-based strategies related to individuals with ASD including characteristics, assessment, treatment approaches, and life-span programming. SPLED 502 Educating Individuals with Autism Spectrum Disorders (3) This advanced seminar will address evidence-based strategies related to working with individuals diagnosed as having Autism Spectrum Disorders (ASD). Course objectives will include familiarity/competency in the following topical areas: a) cognitive, social, and behavior characteristics that affect learning; b) assessment strategies and instrumentation; c) treatment/intervention approaches; d) strategies to assess the validity of interventions according to evidence-based/empirical standards; and e) how to program across the lifespan of the individual with ASD. Course content will be delivered through lectures, discussions, peer presentations, and guest speakers. There are no prerequisites for the course.

SPLED 503A: Applied Behavior Analysis for Special Education: Basic Principles I

4 Credits

Topics include a history of applied behavior analysis; underlying assumptions; dimensions and characteristics of ABA; ethics; basic terminology and principles.

SPLED 503B: Applied Behavior Analysis for Special Education: Basic Principles II

4 Credits

Topics include functional assessment of behavior, ethics, methods to increase and decrease behavior, and generalization.

Prerequisite: SPLED503A

SPLED 503C: Applied Behavior Analysis for Special Education: Extended Applications I

4 Credits

Topics include assessment and intervention for challenging behavior, systems support, classroom applications of ABA, and review of ABA Certification Exam.

Prerequisite: SPLED503A , SPLED503B

SPLED 503D: Applied Behavior Analysis for Special Education: Extended Applications II

3 Credits

In this course students learn additional techniques to promote meaningful behavior change using principles of behavior.

Prerequisite: SPLED503A , SPLED503B , and SPLED503C

SPLED 504: Classroom and School-Wide Management Practices in Special Education

3 Credits

Developing function-based individual interventions as well as class-wide behavior supports for students with disabilities. SPLED 504 Classroom and School-Wide Management Practices in Special Education (3) This course is designed to build upon existing content knowledge and experience in evidence-based classroom management practices including applied behavior analysis and explicit instruction. The overall course objective is to engage students in a review of relevant theories and research on supporting positive behavior change for K-12 students with special needs, and to prepare graduate students to implement effective, evidence-based practices (e.g., classroom structure methods, reinforcement based interventions, behavior reduction strategies) when working with learners with special needs exhibiting a broad range of challenging behaviors (e.g., off task, failure to follow directions, verbal and physical aggression). This course goes beyond introductory-level classroom management courses by presenting the research base for advanced classroom and school-wide behavior change methods that require students to synthesize prior learning with new knowledge into contemporary classroom situations. The course will entail current readings from the professional literature and both individual and group projects intended to enable the learner to apply content to realistic case studies.

Prerequisite: SPLED400 or SPLED401 ; C I 495F

SPLED 505: Single-Case Research

3 Credits

Overview of research methods associated with collecting and evaluating repeated measures on single cases. SPLED 505 Single-Case Research (3) This is an advanced graduate course that introduces students to single-case research design and methodology. This course is designed to provide the student with all the necessary tools needed to formulate questions that require repeated measures observation and analysis, including the use of visual and statistical analytic methods. Intro-subject experimental designs are discussed with particular attention paid to repeated measures analysis of trends and level effect size changes, as well as supportive topics (e.g., observing and recording behavior, observer training and agreement, social validation).

SPLED 509A: Seminar in Literacy Skills Instruction for Students with Disabilities

3 Credits

Review of research in reading instruction for students with disabilities and analysis of implications for classroom practice. SPLED 509A Seminar in Literacy Skills Instruction for Students with Disabilities (3) This seminar builds on prerequisite special education courses in curriculum and instructional methods. Enrolled students will extend their knowledge of the research that examines the use of explicit instructional strategies in the context of reading. Students will review and discuss current research on classroom-based assessment, curriculum development, and instructional strategies for teaching reading to K-12 students with learning disabilities. Students will learn how to select the reading skills necessary to scaffold and enhance learners' present reading skills. Methods for using research-based assessment strategies and developing foundational reading skills within a classroom context will be described.

Prerequisite: SPLED400 ; SPLED403A or SPLED403B

SPLED 509B: Seminar in Writing and Content Literacy Instruction for Students with Disabilities

3 Credits

Evidence-based methods for designing and implementing writing and content literacy instruction for learners with special needs across content areas. SPLED 509B Seminar in Literacy Skills Instruction for Students with Disabilities (3) This seminar builds on prerequisite special education courses in curriculum and instructional methods. Enrolled students will extend their knowledge of the research that examines the use of explicit instructional strategies in the context of reading. Students will review and discuss current research on classroom-based assessment, curriculum development, and instructional strategies for teaching reading to K-12 students with learning disabilities. Students will learn how to select the reading skills necessary to scaffold and enhance learners' present reading skills. Methods for using research-based assessment strategies and developing foundational reading skills within a classroom context will be described.

Prerequisite: SPLED400 ; SPLED403A or SPLED403B

SPLED 509C: Seminar in Mathematics and Science Instruction for Students with Disabilities

3 Credits

Explore advanced methods of effective mathematics and science instruction for students with disabilities. SPLED 509C Seminar in Mathematics and Science Instruction for Students with Disability (3) This seminar builds on prerequisite special education courses in curriculum and instructional methods and is designed for students who desire to develop advanced knowledge of intervention research in mathematics and science and practical application of the most effective instructional practices for students with disabilities. The focus of the course is on developing an indepth knowledge of the scientifically supported instructional and assessment practices for students with disabilities in mathematics and science. This course will cover five key topical areas. In the first area, the high quality indicators of intervention research are explored through a series of readings and classroom discussions. In the second topic area, specific instructional practices supported in the research for teaching mathematics to students with disabilities are presented, discussed, and synthesized. Similarly, in

the third topic area specific instructional practices supported in the research for teaching science to students with disabilities are presented, discussed, and synthesized. In the fourth area, the advanced application of curriculum-based measurement procedures is developed. Finally, in the fifth area, current and emerging technology applications for students with disabilities in mathematics and science are reviewed and presented.

Prerequisite: SPLED400 ; SPLED403A or SPLED403B

SPLED 510: Educational Considerations for Students with Intellectual and Developmental Disabilities

3 Credits

Current and historical approaches to the assessment and instruction of students with intellectual and developmental disabilities.

Prerequisite: SPLED305 ; SPLED401 or SPLED411

SPLED 512: Advanced Instructional Design and Delivery for Students with High-Incidence Disabilities

3 Credits

Explore research underlying effective instruction for students with high-incidence disabilities and use information to design and deliver class lessons. SPLED 512 Advanced Instructional Design and Delivery for Students with High-Incidence Disabilities (3) The purpose of SPLED 512 is to provide advanced discussion and application of appropriate methodology for teaching academic skills to students with significant learning difficulties. The majority of the course deals with a review of the research on (and practical application of) effective practices for designing and delivering academic instruction and independent work to students who do not learn optimally under current conditions within their general education classes. Students will review and discuss both foundational and current research in instructional design for students with learning difficulties. Readings will be drawn from research in general education, special education, cognitive psychology, and educational psychology. Students will read and discuss the research literature on underlying cognitive processes which impact learning for students with learning disabilities (e.g. attention, executive functioning, working memory, prior knowledge) and on intervention research with this population. In addition, students will demonstrate the ability to make practical application of these research-based methods in designing and delivering instruction.

Prerequisite: SPLED403A or SPLED403B

SPLED 515: Infants and Toddlers with Special Needs

3 Credits

Comparison of typical and atypical development of infants and toddlers; applicable instructional strategies in education.

Prerequisite: at least one year teaching experience with elementary-age children

SPLED 516: Assessment in Early Educational Intervention

2-3 Credits/Maximum of 3

Describes and illustrates models, methods, and materials for assessing infants and preschoolers with developmental delays and disabilities.

Prerequisite: SPLED415

SPLLED 520: Current Issues in Special Education

3 Credits

Explore current issues and research in the field of special education.

Prerequisite: SPLLED525

Cross-listed with: EDPSY 520

SPLLED 521: Capstone Seminar in Special Education

3 Credits

Seminar dealing with advanced research analysis, interpretation, synthesis, and presentation in special education. SPLLED 521 Capstone Seminar in Special Education (3) SPLLED 521 is the capstone course of the M.Ed. in Special Education. In this course students develop and present their capstone projects. Projects generally relate to topics explored in both the student's area of emphasis, as well as in an initial research course. Projects may involve quantitative or qualitative data collection or syntheses of literature. Early in the course, students develop and refine research questions of their own interest. After questions are clearly delineated, students learn methods of data collection that will assist in answering their questions. Students will then learn skills needed to write for both practitioner and research outlets. Finally, students will develop and present their key findings to the class using appropriate technology.

Prerequisite: SPLLED573

SPLLED 525: Teaching Learners with Disabilities in Inclusive Settings

3 Credits

Strategies for educating learners with disabilities in inclusive settings with an emphasis on instruction, accommodations, collaboration, and consultation.

Prerequisite: SPLLED400 or SPLLED425

SPLLED 530: Current Issues and Research in Education for Students with Learning Disabilities

3 Credits

Specific learning disabilities is the largest diagnosis for which students receive special education services under the Individuals with Disabilities Education Act. A learning disability has a life-long impact on the individual with the learning disability. The information shared in this course will benefit educators, parents, policy-makers, educational leaders, and other educational stakeholders and school personnel. In this course, learners evaluate and synthesize research and theoretical implications in the educational and behavioral support of students with learning disabilities. Topics include characteristics and diagnosis of learning disabilities, profiles of learning disabilities (e.g., dyslexia), evidence-based practices to support students with learning disabilities, personal experiences with learning disabilities, and myths or common misunderstandings of learning disabilities.

Prerequisite: SPLLED305

SPLLED 540: Orientation to PhD Study in Special Education

3 Credits

Information and skills needed for successful completion of Ph.D. study in Special Education for those targeting academic careers. SPLLED 540

Orientation to PhD Study in Special Education (3) Offered every fall semester, this course is for students new to Ph.D. study in Special Education to prepare them for Candidacy and initiation of a line of research. Students take the course during their first semester in the Program. Based upon special offerings and typical numbers of new Ph.D. students in Special Education the anticipated enrollment will be 5-7 students. The course is intended to provide students frequent feedback on development of basic search skills and skills related to conducting a systematic review of professional literature, a skill that is prerequisite to development of a research agenda. At this point in their development, students are not expected to be able to formulate experimental research questions or use the IRB. They are still at a point at which they need to develop their skills reading and synthesizing current literature as a foundation for future experimental efforts (development of hypotheses, experimental designs, and IRB approvals are all covered in later courses). Students will receive feedback from the instructor and from peers as well as provide it to peers thereby developing their own feedback and editing skills (students actually receive feedback on their feedback). Towards the end, they need to be able to recognize varying forms of literature reviews (differing purposes and methods) and developing a means for conducting their own reviews in a systematic, replicable manner. They need to work on technical writing skills and on organization and using APA style. To accomplish this requires a lot of discussion and analysis of work in separate stages of development of a review. Generally the content includes basic information and skills needed for successful completion of Ph.D. study including: Campus resources, pitfalls, technical writing skills, setting a research agenda (research to practice issues) and conducting systematic reviews of professional literature. While this may not sound like much, it is important to note that this is a highly individualized course with an emphasis on skill development. Therefore, as a result of participation students will: (1) become acclimated to PSU information resources, (2) identify ways to keep on track during PhD study, (3) identify local support networks, (4) locate 3 systematic reviews of the professional literature and identify key features, (5) identify 3 key issues in research to practice in Special Education, (6) complete electronic searches for references on a topic assigned by the course instructor, (7) write an 18-22 page, systematic review (which will include introduction, methods, results, and discussion/implications sections), of the literature on a topic assigned by the instructor and based upon search results, (8) practice formulating "good" (i.e., answerable) research questions, (9) distinguish between plagiarism and appropriate citation of other works, (10) refine technical writing skills (including using APA style), (11) develop feedback/editing skills in the area of technical writing, and (12) prepare an oral presentation of their results complete with visuals. Methods of evaluation are primarily subjective and will include both peer and instructor assessments. Peer feedback during the development of the systematic review will not carry weight toward a final grade although the instructor will provide feedback to peers on their feedback to each student. The instructor's feedback will largely be individual and in writing and orally in private meetings with each student as the review is conducted in steps (e.g. introduction, results, etc.). Instructor's feedback will include areas related to technical writing in Special Education such as correct APA format, organization, substantiating claims, analysis and synthesis skills, and providing solid rationale for the effort.

Prerequisite: admission to Ph.D. study in Special Education

SPLLED 550: Professional Seminar in Special Education

2 Credits

Professional competencies and ethical issues related to obtaining and retaining positions in higher education. SPLLED 550 Professional Seminar

in Special Education (2) SPLED 550, Professional Seminar in Special Education is a required course for all doctoral candidates in the Special Education Program. The purpose of the seminar is to discuss and further develop professional competencies needed to obtain and retain positions in higher education as well as discuss issues related to professional ethics. Topics will include university teaching, applying and interviewing for a job, conference presenting, developing inservice programs and other expectations of higher education not covered in other coursework. In addition, ethical issues related to conducting research and working with students, staff and colleagues will be covered.

Prerequisite: admission to Special Education doctoral program and successful completion of candidacy in special education

SPLED 554: Developing and Interpreting Assessments in Special Education

3 Credits

Advanced assessment of special needs learners including research and legal basis for norm-referenced and informal assessments.

Prerequisite: SPLED573 or equivalent

SPLED 570: Problems in the Education of the Emotionally Disturbed

3 Credits

Current Issues and Research in Education for Students with Challenging Behaviors

SPLED 573: Introduction to Research in Special Education

3 Credits

A seminar to review and design research in special education. SPLED 573 Introduction to Research in Special Education (3) The research literature provides professionals in the field with an array of valuable information. Unfortunately, this literature is, for various reasons, under-utilized by classroom teachers. The ultimate purpose of this class is to help teachers find solutions in the literature to everyday classroom problems. In line with this purpose, teachers will learn how to (a) find information in the literature, (b) evaluate the technical adequacy of the information, and (c) apply the information in their setting.

Prerequisite: SPLED454

SPLED 575: Grant-Proposal Development in Special Education

3 Credits

Designed to facilitate development of grants and proposal writing techniques for submission and funding by student researchers.

Prerequisite: EDPSY400 , SPLED573

SPLED 594: Reserach Topics

1-15 Credits/Maximum of 15

Supervised student activities on research projects identified on an individual or small-group basis.

SPLED 595: Internship

1-12 Credits/Maximum of 12

Supervised off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required. A specific title may be used in each instance and will be entered on the student's transcript. Multiple offerings may be accommodated by the use of suffixes A, B, etc.

SPLED 595A: Practicum

1-6 Credits/Maximum of 6

Supervised clinical experience on campus in University-managed diagnostic and remedial settings.

Prerequisite: SPLED412 . PA Act 34 clearance required. In addition, non-Pennsylvania residents must provide evidence of an FBI background information check. (Forms: 228 Chambers)

SPLED 595B: Field Experiences in Off-Campus Laboratories

1-10 Credits/Maximum of 10

Supervised off-campus field experiences in selected laboratory settings with exceptional children.

Prerequisite: SPLED412 , SPLED595A . PA Act 34 clearance required. In addition, non-Pennsylvania residents must provide evidence of an FBI background information check. (Forms: 228 Chambers)

SPLED 595C: Intern Sp Ed Sup

1-6 Credits/Maximum of 6

Prerequisite: SPLED595B

SPLED 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

SPLED 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

SPLED 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

SPLED 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

SPLED 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Experience in structuring and teaching a college course supervised by a graduate faculty member.

SPLED 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

SPLED 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

SPLED 801: Evidence-Based Student, Classroom, and School-Wide Behavior Supports

3 Credits

Overview of motivation, encouraging positive behaviors, effective classroom management, performance feedback, functional behavior assessment, collaboration, generalization, and maintenance of behavior.

SPLED 802: Design and Delivery of Evidence-Based Instruction for Learners with Special Needs

3 Credits

Evidence-based methods for designing, delivering, and adapting instruction for students with special needs in general education settings.

SPLED 803: Evidence-Based Assessment for Teaching Learners with Special Needs

3 Credits

Overview of special education assessment law, the assessment process, monitoring academic progress, classroom behavior, and assessing learners with severe disabilities. SPLED 803 Evidence-Based Assessment for Teaching Learners with Special Needs (3) This course provides an overview of special education law and methods to assess learners with special education needs in the general education setting. Roughly 15% of the course provides knowledge related to historical and legal foundations of special education that relates to general education teachers and settings. The remaining content focuses on assessing learners with both mild and more severe disabilities in general education settings. Specifically, students will learn how children are identified with special needs and found eligible for special education services. Students will learn about the value and importance of collecting and using data to make informed instructional decisions. Different assessment procedures will also be covered including norm-referenced tests and progress monitoring through the use of curriculum-based measures. Students will learn to create and implement assessments across a variety of content areas such as reading, writing, mathematics, and vocabulary (in social studies or science classes). An important part of data collection procedures is the ability to graph data and subsequently make decisions based on this data; thus, a portion of the course will focus on these skills. Students will also learn how to monitor classroom behavior. Finally, there will be a focus on assessing learners with more severe disabilities. Functional behavior assessments as well as accommodating learners with severe needs will be discussed.

SPLED 806: Foundations of Applied Behavior Analysis

3 Credits

This course covers the foundational underpinnings of the field of applied behavior analysis, which uses principles of behavior to positively impact client outcomes. The field emphasizes an empirical base through the use of experimental analysis of key variables in order to develop evidence-based interventions. This course is divided into two main areas. In the first half of the course, content is centered around behavior as a science and the historical foundations of applied behavior analysis. The second half of the course is comprised of an examination of respondent and operant conditioning as well as basic principles of behavior.

SPLED 807: Concepts and Principles of Applied Behavior Analysis

3 Credits

This course is a prerequisite to subsequent courses in the applied behavior analysis course sequence. This course teaches the basic principles of applied behavior analysis, the building blocks necessary for developing evidence-based behavioral interventions. Defining and operationalizing behavior will be reviewed and then students will take an in-depth look at the principles of reinforcement and punishment. Students will review respondent and operant conditioning and then will learn about contingencies and stimulus control, schedules of reinforcement and the various types of differential reinforcement, and motivating operations. Finally, verbal behavior will be covered including exploration of each of the verbal operants and an overview of the application of verbal behavior training toward communication goals. Throughout the course, an emphasis will be placed on understanding these principles in applied contexts.

Prerequisites SPLED 806

SPLED 808: Assessment of Behavior in Contexts

3 Credits

This course teaches students how to conduct and interpret various behavioral assessments. The course will begin with a discussion of the purpose of assessment, determining the need for behavior analytic services, and record review and intake considerations. Students will then explore various behavioral assessments including skills assessments, preference assessments, direct and indirect functional behavior assessments, and experimental functional analysis. Finally, students will learn how to interpret the results of the assessments to accurately determine the function of problem behavior.

Prerequisites SPLED 505 and SPLED 806

SPLED 809: Behavioral Change Procedures and Management I

3 Credits

This course is a prerequisite to subsequent courses in the applied behavior analysis course sequence. This course utilizes the concepts and foundations taught in the prerequisite courses in order to guide students towards developing the skills necessary in implementing evidence-based practices and selecting the appropriate procedures when targeting behaviors for change. The course will begin with an overview of intervention and will continue with an exploration of reinforcement-based interventions and establishing stimulus control. Students will then take an in-depth look at various instructional procedures including environmental arrangements, imitation, modeling, shaping, chaining, and

equivalence-based instruction. Content will then focus on interventions to decrease target behaviors and will finally conclude with strategies to promote generalization and maintenance of behavior change.

SPLED 810: Behavioral Change Procedures and Management II

3 Credits

As one of the final courses in the applied behavior analysis sequence, this course builds on the concepts taught in the prerequisite courses and will cover organizational behavior management, which can be defined as using a behavior analytic framework to teach students how to train, supervise, monitor, and provide feedback to personnel who are implementing academic and behavior change programs. Students will also take an in-depth look at using function-based assessment to guide the development and implementation of interventions. The course will conclude by covering advanced content in the areas of verbal behavior and equivalence-based instruction.

Concurrents: SPLED 809

SPLED 811: Ethical Considerations for Special Education Populations

3 Credits

Recommended Preparations: SPLED 503A Ethical behavior is a key component of any human service enterprise. Before a special education teacher or behavior analyst can effectively work with a client or student, they must first establish an environment of trust. This trust is built through ethical behavior on the part of the practitioner. In this class students will learn about the governmental and professional disciplinary standards that regulate the field of behavior analysis in special education. Beyond the letter of the law, students will work through case studies where ethical dilemmas are presented in an effort to tease out the underpinnings of ethical behavior. In this class students will work through five major content areas that are related to ethics in behavior analysis. As a foundation, Federal, State, and Local statutes that pertain to the practice of behavior analysis will be presented. Additionally, other key legal issues such as informed consent and privacy will be discussed. Next, students will learn about definitions of ethics along with the most common ethical dilemmas in the field. Relatedly, students will learn about the reporting of unethical behavior. After the more general treatment of ethics, the class will move on to more formal codes of ethical conduct, which include those promulgated by the Council for Exceptional Children and the Behavior Analyst Certification Board. The final third of the class is focused on ethics within practice and includes topics such as working and communicating with families in a responsible manner and strategies to support ethical behavior. After successfully completing this course students should will be able to (a) describe ethical behavior, (b) discuss relevant governmental regulations regarding behavior analysis in schools, (c) discuss the disciplinary standards of the Behavior Analyst Certification Board, (d) discuss the ethical standards of the Council for Exceptional Children, and (e) identify effective communication skills with clients and students

SPLED 867: Practicum in Applied Behavior Analysis

2-4 Credits/Maximum of 10

Supervised experience in applied settings implementing behavior management techniques.

Concurrent: SPLED503A, SPLED503B, SPLED503C, SPLED503D

SPLED 897: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject with a professional orientation that may be offered infrequently.

Statistics (STAT)

STAT 500: Applied Statistics

3 Credits

Descriptive statistics, hypothesis testing, power, estimation, confidence intervals, regression, one- and 2-way ANOVA, Chi-square tests, diagnostics.

Prerequisite: one undergraduate course in statistics

STAT 501: Regression Methods

3 Credits

Analysis of research data through simple and multiple regression and correlation; polynomial models; indicator variables; step-wise, piece-wise, and logistic regression.

Prerequisite: STAT 500 or equivalent; matrix algebra

STAT 502: Analysis of Variance and Design of Experiments

3 Credits

Analysis of variance and design concepts; factorial, nested, and unbalanced data; ANCOVA; blocked, Latin square, split-plot, repeated measures designs.

Prerequisite: STAT 462 or STAT 501

STAT 503: Design of Experiments

3 Credits

Design principles; optimality; confounding in split-plot, repeated measures, fractional factorial, response surface, and balanced/partially balanced incomplete block designs.

Prerequisite: STAT 462 or STAT 501 ; STAT 502

STAT 504: Analysis of Discrete Data

3 Credits

Models for frequency arrays; goodness-of-fit tests; two-, three-, and higher- way tables; latent and logistic models.

Prerequisite: STAT 460 or STAT 502 or STAT 516 ; matrix algebra

STAT 505: Applied Multivariate Statistical Analysis

3 Credits

Analysis of multivariate data; T2-tests; partial correlation; discrimination; MANOVA; cluster analysis; regression; growth curves; factor analysis; principal components; canonical correlations.

Prerequisite: MATH 441, STAT 501, STAT 502

STAT 506: Sampling Theory and Methods

3 Credits

Theory and application of sampling from finite populations.

Prerequisite: calculus; 3 credits in statistics**STAT 507: Epidemiologic Research Methods**

3 Credits

Research and quantitative methods for analysis of epidemiologic observational studies. Non-randomized, intervention studies for human health, and disease treatment. STAT 507 Epidemiologic Research Methods (3) This 3-credit course develops research and quantitative methods related to the design and analysis of epidemiological (mostly observational) studies. Such studies assess the health and disease status of one or more human populations or identify factors associated with health and disease status. To a lesser degree, the course also covers non-randomized, intervention (experimental) studies that may be designed and analyzed with epidemiological methods. This course is a second-level course and complements Biostat Methods, STAT 509, which is focused on clinical (experimental) trials. Together, these two courses provide students with a complete review of research methods for the design and analysis for common studies related to human health, disease, and treatment. Prerequisite are Intro Biostats (STAT 250 or equivalent).

Prerequisite: STAT 250 or equivalent**STAT 508: Applied Data Mining & Statistical Learning**

3 Credits

With rapid advances in information technology, the field of Applied Statistics and Data Science has witnessed an explosive growth in the capabilities to generate and collect data. In the business world, very large databases on commercial transactions are generated by retailers. Huge amounts of scientific data are generated in various fields as well using a wide assortment of high throughput technologies. The internet provides another example of billions of web pages consisting of textual and multimedia information that is used by millions of people. Analyzing large complex bodies of data systematically and efficiently remains a challenging problem. This course addresses this problem by covering techniques and new software that automate the analysis and exploration of large complex data sets. Data Mining methods are introduced by using examples to demonstrate the power of the statistical methods for exploring structure in data sets, discovering patterns in data, making predictions, and reducing the dimensionality by Principal Component Analysis (PCA) and other tools for visualization of high dimensional data. Exploratory data analysis, classification methods, clustering methods, and other statistical and algorithmic tools are presented and applied to actual data. In particular, the course investigates classification methods (supervised learning), and clustering methods (unsupervised learning), and other statistical and algorithmic tools as they are applied to actual data. In addition, data mining and learning techniques developed in fields other than statistics, e.g., machine learning and signal processing, will also be reviewed. The Statistics graduate program also offers more in-depth courses on data mining, STAT 557 and STAT 558. This course focuses on how to use software to investigate and analyze large data sets, whereas STAT 557 and STAT 558 focus more on writing data mining algorithms and the computational aspects of algorithm implementation.

Prerequisite: (STAT 501; STAT 462)**STAT 509: Design and Analysis of Clinical Trials**

3 Credits

An introduction to the design and statistical analysis of randomized and observational studies in biomedical research. STAT 509 Design and Analysis of Clinical Trials (3) The objective of the course is to introduce students to the various design and statistical analysis issues in biomedical research. This is intended as a survey course covering a wide variety of topics in clinical trials, bioequivalence trials, toxicological experiments, and epidemiological studies. Many of these topics do not appear in other statistics courses, although a few topics are covered in greater depth in more advanced statistics courses. Computations are performed via the SAS statistical software package. Evaluation methods include four to five homework assignments, an in-class mid-semester examination and an in-class final examination.

Prerequisite: STAT 500**STAT 510: Applied Time Series Analysis**

3 Credits

Identification of models for empirical data collected over time. Use of models in forecasting.

Prerequisite: STAT 462 or STAT 501 or STAT 511**STAT 511: Regression Analysis and Modeling**

3 Credits

Multiple regression methodology using matrix notation; linear, polynomial, and nonlinear models; indicator variables; AOV models; piecewise regression, autocorrelation; residual analyses.

Prerequisite: STAT 500 or equivalent; matrix algebra; calculus**STAT 512: Design and Analysis of Experiments**

3 Credits

AOV, unbalanced, nested factors; CRD, RCBD, Latin squares, split-plot, and repeated measures; incomplete block, fractional factorial, response surface designs; confounding.

Prerequisite: STAT 511**STAT 513: Theory of Statistics I**

3 Credits

Probability models, random variables, expectation, generating functions, distribution theory, limit theorems, parametric families, exponential families, sampling distributions.

Prerequisite: MATH 230**STAT 514: Theory of Statistics II**

3 Credits

Sufficiency, completeness, likelihood, estimation, testing, decision theory, Bayesian inference, sequential procedures, multivariate distributions and inference, nonparametric inference.

Prerequisite: STAT 513

STAT 515: Stochastic Processes and Monte Carlo Methods

3 Credits

Conditional probability and expectation, Markov chains, Poisson processes, Continuous-time Markov chains, Monte Carlo methods, Markov chain Monte Carlo. STAT 515 Stochastic Processes and Monte Carlo Methods (3) This course provides an introduction to stochastic processes and Monte Carlo methods. The course covers topics usually covered in a standard introductory course on stochastic processes, including Markov chains of various kinds. It also covers modern Monte Carlo and Markov chain Monte Carlo methods. Simulation and computing are emphasized throughout the course. The course is divided into two parts: the first part (roughly 8 weeks) provides an introduction to stochastic processes, while the latter (roughly 7 weeks) focuses on Monte Carlo methods, including Markov chain Monte Carlo. The first part of the course begins with a review of elementary conditional probability and expectation before covering basic discrete-time Markov chain theory and Poisson processes. The course then provides students with an overview of continuous-time Markov chains and birth-death processes. The second part of the course covers Monte Carlo methods. Starting with basic random variate generation, the course covers classical Monte Carlo methods such as accept-reject and importance sampling before discussing Markov chain Monte Carlo (MCMC) methods, which includes the Metropolis-Hastings and Gibbs sampling algorithms, and Markov chain theory for discrete-time continuous-space Markov chains.

Prerequisite: MATH 414 , STAT 414 , or STAT 513

STAT 517: Probability Theory

3 Credits

Measure theoretic foundation of probability, distribution functions and laws, types of convergence, central limit problem, conditional probability, special topics.

Prerequisite: MATH 403

Cross-listed with: MATH 517

STAT 518: Probability Theory

3 Credits

Measure theoretic foundation of probability, distribution functions and laws, types of convergence, central limit problem, conditional probability, special topics.

Prerequisite: STAT 517

Cross-listed with: MATH 518

STAT 519: Topics in Stochastic Processes

3 Credits

Selected topics in stochastic processes, including Markov and Wiener processes; stochastic integrals, optimization, and control; optimal filtering.

Prerequisite: STAT 516 , STAT 517

Cross-listed with: MATH 519

STAT 525: Survival Analysis I

3 Credits

Location estimation, 2- and K- sample problems, matched pairs, tests for association and covariance analysis when the data are censored.

Prerequisite: STAT 512 , STAT 514

STAT 540: Statistical Computing

3 Credits

Computational foundations of statistics; algorithms for linear and nonlinear models, discrete algorithms in statistics, graphics, missing data, Monte Carlo techniques.

Prerequisite: STAT 501 or STAT 511 ; STAT 415 ; matrix algebra

STAT 544: Categorical Data Analysis I

3 Credits

Two-way tables; generalized linear models; logistic and conditional logistic models; loglinear models; fitting strategies; model selection; residual analysis.

Prerequisite: STAT 512 , STAT 514

STAT 551: Linear Models I

3 Credits

A coordinate-free treatment of the theory of univariate linear models, including multiple regression and analysis of variance models.

Prerequisite: MATH 415 or STAT 415 or STAT 514 ; STAT 512 ; MATH 436 or MATH 441

STAT 552: Linear Models II

3 Credits

Treatment of other normal models, including generalized linear, repeated measures, random effects, mixed, correlation, and some multivariate models.

Prerequisite: STAT 551

STAT 553: Asymptotic Tools

3 Credits

A rigorous but non-measure-theoretic introduction to statistical large-sample theory for Ph.D. students. STAT 553 Asymptotic Tools (3) STAT 553 covers most standard statistical asymptotics theory but does not require any knowledge of measure theory (it does not define convergence with probability one, for example). It covers convergence of random variables in both the univariate and multivariate settings, Slutsky's theorem(s) and the delta method, the Lindeberg-Feller central limit theorem, power and sample size, likelihood-based estimation and testing, and U-statistics. Although there is no measure theory in the course, it is a mathematically rigorous course and major results are proved. Many common applications of the theory in mathematical statistics are discussed, and most assignments require the use of a computer.

Prerequisite: STAT 513 and STAT 514

STAT 555: Statistical Analysis of Genomics Data

3 Credits

Statistical Analysis of High Throughput Biology Experiments.

Cross-listed with: BIOL 555, MCIBS 555

STAT 557: Data Mining I

3 Credits

This course introduces data mining and statistical/machine learning, and their applications in information retrieval, database management, and image analysis. STAT 557 Data Mining I With rapid advances in information technology, we have witnessed an explosive growth in our capabilities to generate and collect data in the last decade. In the business world, very large databases on commercial transactions have been generated by retailers. Huge amount of scientific data have been generated in various fields as well. For instance, the human genome database project has collected gigabytes of data on the human genetic code. The World Wide Web provides another example with billions of web pages consisting of textual and multimedia information that are used by millions of people. How to analyze huge bodies of data so that they can be understood and used efficiently remains a challenging problem. Data mining addresses this problem by providing techniques and software to automate the analysis and exploration of large complex data sets. Research on data mining have been pursued by researchers in a wide variety of fields, including statistics, machine learning, database management and data visualization. This course on data mining will cover methodology, major software tools and applications in this field. By introducing principal ideas in statistical learning, the course will help students to understand conceptual underpinnings of methods in data mining. Considerable amount of effort will also be put on computational aspects of algorithm implementation. To make an algorithm efficient for handling very large scale data sets, issues such as algorithm scalability need to be carefully analyzed. Data mining and learning techniques developed in fields other than statistics, e.g., machine learning and signal processing, will also be introduced. Example topics include linear classification/regression, logistic regression, model regularization, dimension reduction, prototype methods, decision trees, mixture models, and hidden Markov models. Students will be required to work on projects to practice applying existing software and to a certain extent, developing their own algorithms. Classes will be provided in three forms: lecture, project discussion, and special topic survey/research applications. Project discussion will enable students to share and compare ideas with each other and to receive specific guidance from the instructors. Efforts will be made to help students formulate real-world problems into mathematical models so that suitable algorithms can be applied with consideration of computational constraints. By surveying special topics, students will be exposed to massive literature and become more aware of recent research. Students are strongly encouraged to survey or present their own applications of data mining and statistical learning in graduate research and carry out discussions on data collection and problem formulation.

Prerequisite: STAT 318 or STAT 416 and basic programming skills

STAT 558: Data Mining II

3 Credits

Advanced data mining techniques: temporal pattern mining, network mining, boosting, discriminative models, generative models, data warehouse, and choosing mining algorithms. IST (STAT) 558 Data Mining II (3) This course is the second course in a two-course sequence on data mining. It emphasizes advanced concepts and techniques for data mining and their application to large-scale data warehouse. Building on the statistical foundations and underpinnings of data mining introduced in Data Mining I, this course covers advanced topics on data mining; mining association rules from large-scale data warehouse, hierarchical clustering, mining patterns from temporal data, semi-supervised learning, active learning and boosting. In addition, to computational aspects of algorithm implementation, the course will also cover architecture and implementation of data warehouse, data preprocessing (including data cleansing), and the choice of mining algorithms for applications. In addition to discriminative models such as CRF and SVM models, the course will also introduce generative models such as Bayesian Net and LDA. A term project will be developed by each student to apply an advanced data mining algorithm to a multi-dimensional data set. Classes will include lectures, paper discussions, and project presentations. Paper discussions will allow students to discuss state-of-the-art literature related to data mining. Project presentations will enable students to share and compare project ideas with each other and to receive feedback from the instructor.

Prerequisite: STAT 557 or IST 557

Cross-listed with: IST 558

STAT 561: Statistical Inference I

3 Credits

Classical optimal hypothesis test and confidence regions, Bayesian inference, Bayesian computation, large sample relationship between Bayesian and classical procedures.

Prerequisite: STAT 514; Concurrent: STAT 517

STAT 562: Statistical Inference II

3 Credits

Basic limit theorems; asymptotically efficient estimators and tests; local asymptotic analysis; estimating equations and generalized linear models.

Prerequisite: STAT 561

STAT 565: Multivariate Analysis

3 Credits

Theoretical treatment of methods for analyzing multivariate data, including Hotelling's T^2 , MANOVA, discrimination, principal components, and canonical analysis.

Prerequisite: STAT 505, STAT 551

STAT 580: Statistical Consulting Practicum I

2 Credits

General principles of statistical consulting and statistical consulting experience. Preparation of reports, presentations, and communication

aspects of consulting are discussed. Students will be working on client provided short on-call and long term projects.

Prerequisites: STAT 502, STAT 505; STAT 508; STAT 557, STAT 503; STAT 504; STAT 506; STAT 510

STAT 581: Statistical Consulting Practicum II

1 Credits

Statistical consulting experience including client meetings, development of recommendation reports, and discussion of consulting solutions. STAT 581 Statistical Consulting Practicum II (1 per semester/maximum of 2) This course serves as a continuation of STAT 580, which provides actual practical experience as a statistical consultant. In STAT 581, each student will hold a consulting session biweekly (by appointment) with a researcher to discuss the statistical design, analysis and computation aspects required for the client's project. Written reports are required for each project and reviewed for appropriateness and accuracy by a supervising faculty member. In addition, a weekly seminar is utilized to discuss selected projects and non-standard applications of statistical methodology. This course will be offered in the spring and summer, with an anticipated enrollment of 15-20 students per semester.

Prerequisite: STAT 580

STAT 584: Machine Learning: Tools and Algorithms

3 Credits

Computational methods for modern machine learning models, including applications to big data and non-differentiable objective functions.

Cross-listed with: CSE 584

STAT 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

STAT 592: Teaching Statistics

1 Credits

This course is designed to help students become better teachers and communicators of statistics. INTAF 592 Teaching Statistics (1) This course is designed to help students become better teachers and communicators of statistics, and specifically to prepare students to supervise undergraduate statistics students in labs or small group settings, or even to lead their own undergraduate courses. Students learn about and discuss pedagogy in statistics, gain experience with practice teaching, and improve via individual feedback.

STAT 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

STAT 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

STAT 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

STAT 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

STAT 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

STAT 800: Applied Research Methods

3 Credits

Investigates methods for assessing data collected from experimental and/or observational studies in various research setting. STAT 800 Applied Research Methods (3) This course provides students with a broad exploration of the tools and methods in Applied Statistics. In particular, it investigates basic probability distributions and methods for assessing data collected from experimental and/or observational studies in social science and other research settings. Students learn methods of point and interval estimation, including sample size determinations required to achieve a prescribed margin of error. Additionally, students examine hypothesis testing and the determination of sample sizes to achieve a prescribed power of a given test. The distinction between observational studies and randomized experiments is clarified and the limitations of the conclusions are emphasized. Research articles that are relevant to students' fields of study are used to determine how these statistical methods are being applied. Students then identify and critique appropriate research methods. Students work with various data sets to establish fundamental practices that properly analyze data and interpret results via either Minitab or SPSS statistical software as they formulate and communicate conclusions based on a given research context.

STAT 805: Multivariate Statistics and Applications

3 Credits

This course is designed to build upon a student's undergraduate quantitative backgrounds by giving an overview of multivariate statistical techniques. Many applied fields often require the use of large, multivariate data sets and students need to be aware of the wide range of statistical tools available to them. Major objectives of this course are to gain a working knowledge of probability theory, univariate and multivariate statistics, the use of copulas, Monte Carlo techniques, and multiple linear regression. Throughout the course, students will have the opportunity to apply these concepts to real world data sets using modern statistical software packages.

STAT 810: Time Series Analysis and Applications

3 Credits

This course is designed to build upon a student's background by giving an overview of the techniques of time series analysis often used in applied settings. Many areas of research and application often utilize long time series of data in an effort to model changes and volatility in data measured consistently over time. Major objectives in this course include an overview of linear time series; AR, MA, and ARIMA models; ARCH and GARCH models; nonlinear time series models; multivariate time series models; and models of high-frequency data. Throughout the course, students will have the opportunity to apply these concepts to real world data sets using modern statistical software packages.

Prerequisite: (MFE 801, STAT 805; STAT 505)

STAT 897: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.

STAT 897D: **SPECIAL TOPICS**

3 Credits

Supply Chain and Information Systems (SCIS)

SCIS 501: Business Analytics

3 Credits

SCIS 501 develops students' understanding of and ability to apply a variety of business analytic tools and techniques to describe data, make predictions, and prescribe optimal solutions. Students will explore some of the following topics: Data Visualization, Exploring Data with R, Regression simple and multiple, Logistic regression, Classification trees, Machine learning for regression (data adaptive), Deterministic optimization (linear, integer, nonlinear), Monte Carlo Simulation, Decision Analysis. These topics enable students to address issues in descriptive, predictive, and prescriptive business analytics. Students will learn how to bridge descriptive, predictive, prescriptive analytics across a variety of business scenarios. Software packages, concepts, and business applications will vary and evolve to keep pace with technology, theory, and instructor interest. This course is focused more on the methodological aspects of business analytics.

Prerequisite: BA 511

SCIS 502: Supply Chain Strategy

3 Credits

SCM 502 develops students' ability to understand strategic decisions across the end-to-end supply chain. This course takes a systems perspective to understand critical decisions in the supply chain that encompasses issues related to make, source, deliver and return of goods and services. It links these decisions to the firm's business strategy and financial outcomes. The course also connects these decisions to related research in supply chain management and emerging issues in practice. It takes a problem-driven approach to scholarship in supply

chain management, where we examine problems in supply chain management, connect these problems to research, and explore new research questions to study. Students will learn critical decisions in supply chain management, key concepts to understand these decisions, and the ability to formulate new research questions.

SCIS 505: Management Information Systems Research

1-3 Credits/Maximum of 3

Research problems and issues in supply chain and information systems. SC&IS 505 Management Information Systems Research (3) This is a Ph.D. level course designed to familiarize students with information systems theories and research methodologies. Special emphasis is given to the design science paradigm and, specifically, to process and data modeling of information systems problems using techniques like UML, XML, and Petri-nets. In addition, workflow systems as an application of process modeling will be studied. After completing this course, students will have the knowledge, skills, and abilities to discuss and critically reflect on: a) Information system research paradigms b) Information system modeling techniques c) Coordination theory d) Workflow models, management and architectures e) Information systems in supply chains This is a prescribed research foundation course. Student evaluations are based on class participation, individual and group assignments, and exams. This course will be offered during Fall semester for 5-10 students.

SCIS 510: Introduction to Supply Chain and Information Systems

3 Credits

Introduction to the strategic framework, issues, and methods for integrating supply and demand management within and across companies. SC&IS 510 Introduction to Supply Chains and Information Systems (3) This course introduces the strategic framework, the managerial issues, and the methodologies for integrating supply and demand management within and across companies. Both theoretical and quantitative perspectives will be offered on these topics. Additionally, each topic will be addressed from strategic, financial, and research perspectives. After completing this course, students will have the knowledge, skills, and abilities to discuss and critically reflect on: a) supply chain theories, methodologies, trends, best practices, and research issues b) core supply chain processes c) strategic and financial impacts of supply chain management d) role of information systems This is the first of four prescribed foundation courses. Student evaluations are based on class participation, individual and group assignments, and exams. This course will be offered during Fall semester with resident enrollment limits set at 20 students.

SCIS 516: Applied Stochastic Processes

3 Credits

Study of stochastic processes and their applications to engineering and supply chain and information systems. I E (SC&IS) 516 Applied Stochastic Processes (3) This course covers the mathematical fundamentals and tools for analyzing stochastic systems evolving over time, including concepts and techniques related to Poisson Processes, renewal processes, and discrete and continuous time Markov chains. Students will also learn to build probabilistic intuition and insights when thinking about random processes. Additionally, students will learn to apply the essential techniques of stochastic processes to real world problems in the supply chain and information systems area. This is a prescribed research foundation course for Ph.D. students in SC&IS.

Student evaluations are based on class participation, individual and group assignments, and exams. This course will be offered during Spring semester to approximately 5-10 students.

Prerequisite: I E 322 or STAT 318

Cross-listed with: IE 516

SCIS 519: Dynamic Programming

3 Credits

Theory and application of dynamic programming; Markov decision processes with emphasis on applications in engineering systems, supply chain and information systems. I E (SC&IS) 519 Dynamic Programming (3) This course presents the basic theory and applications of dynamic programming. The focus of the course will be on the theory of Markov decision processes (MDP), which provides an analytical tool to optimally control the behavior of a Markov Chain. The students will learn fundamental MDP models, computational methods and applications in supply chain and information systems, including production and inventory control, quality control, logistics, scheduling, queueing network, and economic problems. Student evaluations are based on class participation, individual and group assignments, and projects. This course will be offered during Spring semester for approximately 5-10 students.

Prerequisite: I E 516 or SC&IS516 or equivalent

Cross-listed with: IE 519

SCIS 520: Principles of SC&IS I

3 Credits

Initial course on principles of supply chain and information systems with special emphasis on potential research topics. SC&IS 520 Principles of SC&IS I (3) This is the first of two courses covering principles, research problems and issues in supply chain and information systems. The course familiarizes students with a wide range of appropriate research topics and prepares them to initiate doctoral level research in these areas. Topics include: logistics network design, transportation and distribution, management production and inventory management, supply chain integration and coordination, workflow systems, and process and data modeling of information systems. Evaluation methods include homework assignments, research paper(s), presentations, and class participation and discussion. Offered in the fall semester only. SC&IS 510 is a prerequisite.

Prerequisite: SC&IS510

SCIS 525: Supply Chain Optimization

3 Credits

Introduction to theory and practice of optimization methods and models for analyzing and improving the performance of supply chain environments. SC&IS 525 Supply Chain Optimization (3) This course introduces students to the optimization methods and models that are applicable to managing supply chains and provides a quantitative foundation for research in supply chain management. The primary objective is to investigate the theory and practice of optimization methods, especially as they apply to managing large, interconnected supply chains. The investigation includes mathematical programming techniques, modeling approaches, and optimization languages. This is a required course for Ph.D. students in SC&IS and an element of a set of methodological courses designed to provide a framework for analytical

study of supply chain management. The course may also serve graduate students in related fields of study. Student evaluations are based on individual and group assignments or projects and examinations. This course will be offered during Spring semester to approximately 5-10 students.

Prerequisite: prior coursework in linear algebra and calculus

SCIS 530: Principles of SC&IS II

3 Credits

Sequel on principles of supply chain and information systems with special emphasis on potential research topics. SC&IS 530 Principles of SC&IS II (3) This sequel to SC&IS 520 is directed at first and second year Ph.D. students in the SC&IS program. Other graduate students are welcome to attend with instructor's permission. The objectives are to (1) study supply chain and information system principles, (2) expose students to a wide range of appropriate research topics, and (3) prepare students to conduct doctoral level research in these areas. Topics include planning, integration, and coordination; value and impact of information; game theory models, auctions, and behavioral issues. Evaluation methods include homework assignments, research paper(s), presentations, and class participation and discussion. This is the second part of a two-course sequence covering research problems and issues in supply chain and information systems. Offered in the spring term only. SC&IS 510 is a prerequisite.

Prerequisite: SC&IS510

SCIS 535: Statistical Research Methods for Supply Chain and Information Systems

3 Credits

Current statistical research methods for modeling and analysis of supply chain and information systems. SC&IS 535 Statistical Research Methods for Supply Chain and Information Systems (3) This is a Ph.D. level course that requires in-depth study of statistical research methods for observational analysis and modeling of supply chain and information systems. Special emphasis is given to five methods of statistical inference: a) Estimation b) Comparison of K-groups c) Forecasting d) Data mining e) Decision-making under uncertainty. Student evaluations are based on class participation, individual and group assignments, and exams. This course will be offered during Fall semester for approximately 5-10 students.

Prerequisite: 3 credits each in undergraduate accounting, economics, and statistics

SCIS 540: Transportation and Distribution Management

3 Credits

Transportation and distribution systems in supply chains. Emphasis on role of system cost, price, service elements in total order management. SC&IS 540 Transportation and Distribution Management (3) This course focuses on the role of transport and distribution systems in new supply chain business models, with special emphasis given to total order management. Transportation system topics cover economic conditions, managerial strategies, governmental policies, and other phenomena, which affect the demand for and supply of transport and distribution services. Course design is directed toward graduate students with relatively little or no previous academic work in transport management and economics. Student evaluations are based on class participation,

individual and group assignments, and exams. This course will be offered during the Fall semester with resident enrollment limits set at approximately 20 students.

SCIS 545: Supply Chain Systems Simulation

3 Credits

Application of computer simulation to analysis and design of supply chain and information systems design; simulation experiments in SC&IS research. SC&IS 545 Supply Chain Systems Simulation (3) This course will provide an introduction to Monte Carlo and discrete-event simulation. Material will be aimed at the students who need to use simulation as a research tool at a sophisticated level. Although the focus of the course is the application of simulation to the analysis and design of supply chain and information decision systems, the material in this course will be appropriate for a much broader range of applications. Some time will be spent constructing simulation models of real-world systems, but the bulk of the course will be devoted to the statistical analysis required for correctly specifying input processes and interpreting the output of simulation models. This is an elective course for graduate students in SC&IS, which may also serve graduate students in related fields of study. Student evaluations are based on a series of classroom assignments. This course will be offered during Spring semester to approximately 5-10 students.

Prerequisite: 3 credits of computer programming

SCIS 546: Procurement and Supply Management

3 Credits

Analysis, planning, and management of domestic and international procurement and supply activities. SCIS 546 Procurement and Supply Management (3) SCIS 546 provides an overview of procurement and supply management in the context of domestic and global supply-chain networks. Special emphasis is given to strategic sourcing relationships, supply management "best practices," and E-perspectives on supply management. The course uses problem-based learning and emphasizes the case method. The goal is to learn through the application of course materials to relevant supply management case problems and scenarios. Collaboration in case preparation is required. Student evaluations are based on class participation, individual and group assignments, and exams. This course will be offered during the Fall semester with resident enrollment limits set at 20 students.

SCIS 560: Seminar in Transport Economics and Policy

3 Credits/Maximum of 6

Comparative analysis of theoretical and empirical studies in transport cost, demand, pricing, and policy problems. SC&IS 560 Seminar in Transport Economics and Policy (3-6) This course is designed for Ph.D. students interested in intensive study of transportation economics and policy research and current issues. Student evaluations are based on class participation, individual and group assignments, and written exams. This course will be offered during the Spring semester with resident enrollment limits set at approximately 20 students.

SCIS 565: Supply Chain Strategy

3 Credits

Strategies, issues and best practices in technology adoption, change management, financial/capability assessments, critical aspects of

relationship management in supply-chain networks. SC&IS 565 Supply Chain Strategy (3) The course focuses on the strategic design and the effective operation of supply chains. It specifically seeks to integrate topics foundation course and to engage students in the critical analysis and in probing discussions of specific supply chain leadership issues. Special emphasis is given to supply chain technology adoption, change management, shareholder value assessment, capability assessment, relationship management, and performance metrics.

Prerequisite: SC&IS510

SCIS 570: Supply Chain Engineering

3 Credits

Use of operations research models and methods for solving problems in supply chain systems. IE 570 / SCIS 570 Supply Chain Engineering (3) The course provides state-of-the-art mathematical models, concepts and solution methods important in the design, control, operation and management of global supply chains. It provides an understanding of how companies plan, source, make and deliver their products to create/or maintain a global competitive advantage. It emphasizes the application of operations research models and methods to optimize the various components of an integrated supply chain. The course is appropriate for graduate students interested in working in the supply chain area in industry as well as those planning to pursue research in supply chain optimization.

Prerequisite: IE 405 , IE 425 , or SC&IS510

Cross-listed with: IE 570

SCIS 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses. A specific title may be used in each instance and will be entered on the student's transcript.

SCIS 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

SCIS 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

SCIS 601: Thesis Preparation

0 Credits/Maximum of 999

No description.

SCIS 610: Thesis Research

1-15 Credits/Maximum of 999

No description.

SCIS 611: Thesis Preparation

0 Credits/Maximum of 999

No description.

Supply Chain Management (SCM)

SCM 540: Transportation in Supply Chains

2 Credits

Strategies and processes for design and implementation of transportation service links in supply chain networks.

Prerequisite: B A 510 or permission of program

SCM 546: Strategic Procurement

2 Credits

Development of procurement and supply management strategies to support synchronized supply chains.

Prerequisite: B A 510 or permission of program

SCM 556: Manufacturing Strategy

2 Credits

Development of service-sensitive manufacturing strategies to support synchronized supply chains.

Prerequisite: B A 510 or permission of program

SCM 566: Demand Fulfillment

2 Credits

Demand fulfillment strategies, operations, and methods in supply chain networks.

Prerequisite: B A 510 or permission of program

SCM 570: Supply Chain Modeling

2 Credits

Explore current modeling methods and software for design, analysis, execution and integration of supply chains.

Prerequisite: SCM 556

SCM 594: Research Topics

1-15 Credits/Maximum of 15

Supervised student activities on research projects identified on an individual or small-group basis.

SCM 595: Internship

1-9 Credits/Maximum of 9

Supervised off-campus, nongroup instruction, including field experiences, practicums, or internships.

SCM 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

SCM 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

SCM 800: Supply Chain Management

3 Credits

This course provides an enhanced understanding of key principles, concepts, and methodologies for effective supply chain management. Supply chain management is the integration of core business processes from the end user through original suppliers that provides products, services, and information that add value for customers. The systems viewpoint and a process orientation are explored at the firm level and from the perspective of inter-firm collaboration among participants in supply chains. The course provides opportunities to investigate important topics such as the bullwhip effect, the key approaches to planning and managing inventory across supply chains, the creation of value through alignment and realignment of supply chain capabilities, and the key supply chain performance metrics. Students successfully completing the course will be able to: - Articulate the essential principles and concepts of the supply chain approach - Demonstrate understanding of the potential role of supply chains in creating value and in sustaining competitive positions of firms - Explain the impact of the bullwhip effect on supply chain performance - Demonstrate understanding of the underlying causes of the bullwhip effect and articulate the principal approaches to ameliorating its impacts on supply chain performance - Articulate differences in the principal approaches to managing inventories across supply chains - Articulate the principal benefits and challenges associated with collaborative approaches to supply chain management - Demonstrate understanding of the principal metrics used to manage supply chain performance

SCM 801: Supply Chain Performance Metrics and Financial Analysis

3 Credits

Performance metrics are essential for effective planning and management of supply chain operations. Clear understanding of the relationship between supply chain decisions/initiatives and the firm's primary financial measures is an increasingly important competency for all supply chain managers. SCM 801 provides professional-level coverage of essential supply chain performance and financial metrics applied both within the firm and across the extended enterprise. The course helps students develop the ability to choose and utilize the correct set of performance and financial metrics for varying supply chain decision-making situations. Students learn how to leverage key supply chain decision variables to impact performance and financial metrics. Students also learn to apply appropriate accounting tools and techniques and conduct financial analyses to evaluate and optimize supply chain decisions. Topics addressed include inventory and financial metrics, measures of supply chain velocity, working capital, ratio analysis, the Strategic Profit Model, total cost of ownership, the Balanced Scorecard, and the SCOR Model. Additionally, the course will utilize various financial

tools and techniques (such as Discounted Cash Flow Analysis, Ratio Analysis, Breakeven Point Analysis, and Cost Volume Profit Analysis) to demonstrate the impact of supply chain principles and concepts on the performance of a firm. Students successfully completing the course will be able to:

- Identify, describe, and measure the essential metrics that are the key indicators of supply chain performance, particularly as that performance relates to financial performance of the firm and the extended enterprise
- Identify and assess the perspectives of alternative stakeholders that analyze and use financial metrics and statements
- Utilize various tools/models (working capital evaluation, ratio analysis, etc.) to calculate, analyze, and gain better insights on the interplay between supply chain decision making and financial performance
- Utilize discounted cash flow models to evaluate supply chain investment proposals
- Describe the role of supply chain costs on the income statement and balance sheet of a firm while understanding different types of costs, cost drivers, and breakeven point evaluation (BEP)
- Demonstrate understanding of how the sales and operations plan is developed and its role in supply chain processes
- Compare various viewpoints regarding performance metrics and the constraints that inhibit effective implementation and utilization of those metrics

CONCURRENT: SCM 800

SCM 810: Transportation and Distribution

4 Credits

Role of transportation and distribution operations in matching supply with demand; principles of transport industry analysis and competitive positioning. SCM 810 Transportation and Distribution (4) The course is set against a background of microeconomic theory and in a framework of supply chain management. Course design is directed toward graduate students with relatively little or no previous academic work in transport management and economics. Subject coverage includes both conceptual and applied material, such as the principles of industry analysis and competitive positioning; theory and practice of transport demand, costing, pricing, and revenue and demand management in distribution settings. After completing this course, students should have the knowledge, skills, and abilities to:

- a. Perform an industry analysis and assess a firm's competitive positioning in its industry
- b. Explain the principal categories of cost in a transport/distribution operation and how those cost categories behave with changes in the level of activity
- c. Perform a basic activity-based costing analysis for a transport/distribution operation
- d. Articulate the principal characteristics of transport demand
- e. Understand the measure of price elasticity of demand and to use this measure to quantify the revenue impact of price changes
- f. Articulate principal distribution strategies
- g. Calculate a cost-based price and a differential price
- h. Explain the principles and primary applications of revenue and demand management

The evaluation of students is based on small team case study submissions, individual short paper and problem assignments, on-line discussion postings, and peer reviews. This course is a prescribed course for the on-line Master of Professional Studies in Supply Chain Management (MPS/SCM). The course is the second course in the first year of study, building on foundation knowledge developed in the first course but with a focus on the deliver portion of the supply chain.

Prerequisite: SCM 800

SCM 812: Demand Fulfillment

2 Credits

This course covers the forecasting and inventory management activities involved in the fulfillment of demand for finished goods. This course covers the supply chain activities related to demand planning and inventory management involved in the fulfillment of demand for finished goods. This will include an introduction to the Sales and Operations Planning (S&OP) framework and the role of demand planning in this framework. The students will develop a basic understanding of forecasting and inventory models, including how to evaluate the performance of these models and manage demand and lead time variability. The course will also help students understand the implications of setting service level targets on inventory, as well as manage cost and service tradeoffs in the demand fulfillment process.

Prerequisite: SCM 800

SCM 813: Sustainable Supply Chain Management

2-3 Credits

Exploration of new business models and sustainable design principles for reinventing products and services to drive business value while reducing environmental and social impact, sourcing raw materials and working effectively with suppliers to safeguard labor and human rights, and protecting and restoring natural resources, while reducing total cost and risk. Special focus on circular economy strategies and closed loop supply chains. Traditional supply chain fundamentals are necessary but not sufficient in understanding and strategically managing emergent environmental and social costs, risks, and opportunities. Driving this change is a combination of pressures from customers, suppliers, competitors, employees, regulations, and resource constraints. This course is designed to equip supply chain students with the latest tools, concepts, and business practices for managing an environmentally and economically sustainable supply chain.

SCM 814: Logistics and Transportation Management

4 Credits

The role of logistics and transportation in matching supply with demand.

Prerequisite: SCM 812

SCM 815: Product Realization: Development, Manufacturing, and the Supply Chain

4 Credits

Integration of product development, production, and supply chain processes required to launch products from design concept to steady state manufacturing.

SCM 820: Strategic Procurement

4 Credits

Strategic planning for the source/buy process, including developing and managing supplier relationships, global issues, and e-procurement. SCM 820 Strategic Procurement (4) The course provides a special emphasis on the development and management of strategic sourcing relationships and promotes an understanding of the strategic role of supply management in effective supply/demand/value chain operations. Students learn through the application of course materials to relevant

supply management case problems and scenarios. Collaboration in case preparation is required. Online discussions, "what if scenarios," and contemporary problems enhance the learning experience. After completing this course, students should have the knowledge, skills, and abilities to: a. Understand the strategic role of supply management in effective supply/demand/value chain management. b. Understand the potential impact of supply management on the competitive success and profitability of business organizations. c. Articulate supply management best practices and understand the circumstances under which they work or do not work as well. d. Understand key issues and approaches in relation to strategic supply management, including: supply relationship management, supply segmentation, and the outsourcing decision. e. Plan and execute negotiation strategies. f. Explain developments and technologies in e-Business and e-Procurement and their implications for supply chain management. View and examine future trends in both e-Business and e-Procurement. g. Understand basic issues related to global sourcing. h. Articulate the challenges and opportunities for supply management in the future. The evaluation of students is based on small group case study submissions, individual case study submissions, a small group negotiation exercise, on-line discussion postings, and peer reviews.

Prerequisite: SCM 800

SCM 822: Supply Management

3 Credits

This course provides a broad exploration of selecting, evaluating, and determining the nature of relationships with suppliers from the buyer's perspective within the context of industry and market knowledge. Additionally, the course seeks to develop the ability to understand ethical conduct in business organizations. In particular, the course investigates Supply Market Analysis, Spend Analysis, Supplier Segmentation, Supplier Cost Management, Supplier Selection and Evaluation, Business Ethics, and Negotiation.

Prerequisite: SCM 800

SCM 824: Strategic Procurement

3 Credits

This is an advanced course in strategic procurement. It examines the alignment of an organization with its suppliers through an intensive analysis of outsourcing and offshoring decisions, evaluation and selection of appropriate transportation alternatives, determination of resiliency in the design of the supplier network, measurement of supplier performance and methods, and building cognizance of future issues and developments whereby the continuity of supply may be disrupted.

SCM 830: Supply Chain Analysis

3 Credits

This course provides an overview of the art and science of converting fuzzy business situations into quantitative supply chain models followed by an analysis and recommendation. We discuss methods that are used extensively in business organizations to solve large, structured problems. Such methods generate results that support decision-making at all levels of the organization over various time horizons. Secondly, these methodologies should improve your own problem-solving skills. We stress an approach to problem solving that helps the decision-maker to (a) consider a richer set of alternatives, (b) understand and question assumptions, and (c) consider diverse measures of performance. Major

topics include Decision analysis, Monte Carlo simulation, Optimization and Linear programming.

Prerequisite: SCM 801 or SCM 822 or SCM 842

SCM 840: Supply Chain Project Management

4 Credits

The fundamentals and tools of managing supply chain projects, with special emphasis given to related information technology projects. SCM 840 Supply Chain Project Management (3) This course explores the principles, concepts, and tools of managing supply chain projects, including project activity that requires a commitment of resources and people to an often strategically important undertaking that is not repetitive and short term. Special emphasis is given to IT related projects in supply chains. After completing this course, students should have the knowledge, skills, and abilities to: a. Articulate the critical project management elements and the sequence of these elements in bringing a project to fruition and success. b. Charter and organize a cross-supply-chain project teams capable of achieving project success. c. Use and apply the essential project management tools such as CPM, PERT, and Project to complete supply chain projects. d. Determine project risks, costs, and advantageous alternative project paths. Evaluation methods include a combination of written assignments and case studies, exercises, projects, and on-line discussion postings. This course is a prescribed course for the on-line Master of Professional Studies in Supply Chain Management (MPS/SCM). The course is taken in the second year of study, building on supply chain management knowledge developed in three foundation courses taken in the first year.

Prerequisite: SCM 800 , SCM 810 and SCM 820

SCM 842: Operations Management and Demand Fulfillment

3 Credits

This course covers core concepts of the production function in the supply chain. It gives students an overview of the strategic position of the operations function of a firm and gives an understanding of best principles and practices in process design and control. It also gives students an overview of the basic foundations of project management, which is used to implement product and process improvements in the production functions of a firm. The course also covers the supply chain activities related to demand planning and inventory management involved in the fulfillment of demand for finished goods. This will include a review of the Sales and Operations Planning (S&OP) framework and the role of demand planning in this framework. The students will develop a basic understanding of forecasting and inventory models, including how to evaluate the performance of these models and manage demand and lead time variability. The course will also help students understand the implications of setting service level targets on inventory, as well as manage cost and service tradeoffs in the demand fulfillment process. Upon successful completion of this course, the student will be able to:

- Visualize production systems in terms of the environment, strategy, inputs, the transformation process, outputs, and a control mechanism
- Identify frameworks used in developing a business strategy and recall the components of competitiveness
- Appraise the strengths and weaknesses of transformation systems and select the most appropriate transformation system(s) for a product or service
- Interpret the purposes and methods of process monitoring and control
- Utilize project management for process improvement
- Demonstrate understanding of best practices in forecasting and inventory management
- Evaluate

performance of different models - Manage demand and lead time variability

Prerequisite: SCM 800

SCM 844: Global Manufacturing and Service Operations

3 Credits

A detailed review of concepts, tools, and strategies for managing manufacturing and service operations. This course teaches theory and high-level topics in the manufacturing and services sectors. Key production functions of the supply chain along with the tools and techniques used for improving manufacturing and operations management are reviewed within the framework of current and emerging supply chain theories and optimization processes. Specific topics include Process Analysis, Process Monitoring and Control, Theory of Constraints, Process Planning and Execution, Process Improvement, and Supply Chain Strategies related to manufacturing and services.

Prerequisite: SCM 842

SCM 846: Emerging Topics in Supply Chain Management

3 Credits

SCM 846 provides an enhanced understanding of emerging concepts in supply chain management. For this course, supply chain management is defined as "the integration of key business processes from the end user through original suppliers that provide products, services, and information that add value for customers. Beginning with this lifecycle understanding, the course will identify emerging developments that have the potential to alter competitive balance, planning assumptions, cost structures, and conventional timelines. Given trends in globalization, information technology, demographics, and supply chain practice, new innovations have the potential to facilitate both improvement in the performance of existing systems and the disruption of current sources of competitive advantage. Thus, the course focuses on "weak signals" that have yet to enter the mainstream of supply chain management theory or practice. As a result, the selection of topics will evolve with the state of practice.

Prerequisite: SCM 801 or SCM 822 or SCM 842

SCM 850: Supply Chain Design and Strategy

3 Credits

The focus of this course is the strategic design of supply chain networks. Supply chain design decisions have extraordinary impact on the cost and service value attributes of a product or service over its lifetime. The influence of supply chain design on a firm's profitability and competitive positioning is one reason why competition today extends beyond firm versus firm to supply chain versus supply chain. Supply chain design decisions are among the most financially influential and long-lasting business decisions and yet, supply chain designs should not be static. Ever increasing customer requirements, expanding product lines and customer segments, decreasing product life cycles, and competitive pressures enabled by a growing range of flexible supply chain designs constantly force supply chain executives to evaluate and modify their current supply chain networks and the role of the supply chain in their firm's overall strategy. This course provides an examination of (1) the role of supply chain network design within the context of the firm's competitive strategy, (2) alternative supply chain designs and the factors that influence network design decisions, (3) a framework for the network

design process, and (4) the principal models and techniques used for the design of supply chain networks. Students successfully completing the course will be able to: - Explain the importance of achieving strategic fit between a firm's competitive strategy and the design of the firm's supply chain network. - Describe the basic decision-making framework for achieving strategic fit. - Identify the key questions in network design for supply chains - Identify the principal supply chain network design alternatives - Enumerate the principal factors influencing choices among alternative supply chain designs - Present a framework for the supply chain network design process - Examine the principal models and techniques used for making network design decisions - Explain the influence of demand and supply uncertainties on network design choices

Prerequisite: SCM 801, SCM 822, SCM 842

SCM 860: Supply Chain Transformation and Innovation

3 Credits

Strategy, supply chain innovation, transformation, and leadership are the key themes throughout this course. This course is designed to address strategic management issues and offers many framework models for consideration. The course also includes leadership frameworks and insights for more impactful business management through transformational changes, risk mitigation, and crisis management. The course is designed around four major subjects: Fundamental Dimensions of Strategy - Compare/contrast different perspectives on business strategy - Connecting supply chain strategy to business strategy - Best in class supply chain strategies: which one fits the mark? - Supply chains within the context of volatility, market uncertainty, and disruptions - Optimizing the Supply Chain Diamond: interdependence of customer satisfaction, asset utilization, revenue growth, and supply chain costs. Supply Chain Innovation - Disruptive innovation vs. frugal innovation - How many SC innovations are truly revolutionary? - What does it take to remain a SC leader? Supply Chain Transformation - Defining supply chain transformation: key strategies and capabilities - Supply chain transformation process model - Learning to live with complexity - Distribution strategies for omni-channel - Deep Dive: innovation, consumer-led transformation, and lead time reduction for long term revenue growth Organizational and Personal Leadership - Leading change: why transformation efforts fail? - Change management during logistics outsourcing - SC risk assessment, mitigation, and crisis management - Leadership challenge: keeping pace with skills needed - Professional career map for path forward after graduation Upon successful completion of this course, students will be able to discuss, analyze, and demonstrate understanding of: - Fundamental dimensions of strategy - Connecting supply chain strategy to business strategy - Guiding supply chains through recessionary, uncertain, and volatile business environments - Different ways for businesses to innovate - Strategies and capabilities for supply chain transformation - Organizational leadership traits and models to drive success in the workplace - Personal leadership including working constructively in virtual teams and peer feedback - Creating a professional development framework for their careers

Prerequisite: SCM 801, SCM 822, SCM 842

SCM 863: Managing Supply Chain Risk and Resiliency

3 Credits

This course is designed to teach students to identify, assess and implement strategies and tactics for managing supply chain risk by building and maintaining resiliency in the supply chain. The case is

made for supply chain resiliency, models and theory are presented for managing risk, practical tools for building and improving supply chain resiliency are taught, and cases demonstrating best practices in industry are studied. The successful student will then be prepared to design, build and maintain resilient supply chains.

Prerequisite: SCM 800 Recommended Preparations: Understanding the foundations of Supply Chain Management is a necessary pre-requisite to success in this course.

SCM 896: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

Systems Engineering (SYSEN)

SYSEN 507: Systems Thinking

3 Credits

The theory and practice of systems thinking. General systems theory; system dynamics, emergent properties, structure, feedback and leverage.

Cross-listed with: EDSGN 507

SYSEN 510: Engineering Analysis I

3 Credits

The course includes applications of advanced engineering mathematics; the study of systems are described by ordinary/partial differential equations and methods of solutions.

Prerequisite: students should have completed calculus at the undergraduate level or have instructor's permission

SYSEN 520: Systems Engineering

3 Credits

Fundamentals of Systems Engineering with focus on System methodology, design, and management; includes life cycle analysis, human factors, maintainability, serviceability/reliability.

Prerequisite: SYSEN510 or instructor's permission

SYSEN 522: Systems Verification Validation & Testing

3 Credits

The theory and practice of verification, validation and testing of engineering systems.

SYSEN 531: Probability Models and Simulation

3 Credits

Provides background in modeling problems containing random components that must be accounted for in a reasonable solution.

SYSEN 532: Simulation in Systems Engineering: Discrete-Time Systems

3 Credits

The scale and cost of typical systems engineering projects mandate that proposed solutions are explored through integrated models and simulations such that stakeholders are confident that the system will work as intended upon deployment. In this course we examine the use of discrete-time approaches to these integrated models and their application to systems engineering. The course covers fundamental concepts, methods, and applications of modeling and simulation with a particular emphasis on problem framing, conceptual model development, and modeling systems of interconnected heterogeneous systems using hybrid simulation. The course begins with an overview of different types of systems and models, model verification and validation processes, sources of randomness and uncertainty, and reviews basic concepts related to computer simulation. Students are given an overview of two types of simulation, namely Monte Carlo and discrete event simulation. Basic concepts related to input modeling, experimentation, and output analysis are covered. Students will then learn how to combine the two simulation methods and develop hybrid simulations to model a system of interconnected subsystems and the importance of modeling these interrelationships. The students also gain hands-on experience on additional topics such as simulation-based optimization by using a commercial simulation software package.

SYSEN 533: Deterministic Models and Simulation

3 Credits

Provides a background in simulation and the modeling of problems that contain differential equations as part of the system.

SYSEN 534: Simulation in Systems Engineering: Continuous-Time Systems

3 Credits

This course addresses system dynamics modeling and simulation for the analysis of complex systems. It provides the theoretical and technical knowledge necessary to conceptualize dynamics of complex systems, formulate appropriate simulation models, and use models to understand the system behavior and develop effective policy interventions. Students are exposed to the techniques used to form models of supply-demand, mechanical, electrical, biological, and hybrid systems. The course starts with an overview of system dynamics (SD) as a "set of conceptual tools that enable us to understand the structure and dynamics of complex systems". Then, students learn about tools and techniques that enable us to use SD as a rigorous modeling method to build formal computer simulations of complex systems. Also, the use of computer-based simulation software packages will be addressed. After understanding how to test the validity of the simulation model, and analyze the sensitivity of the model to uncertainty in parameters and/or structural changes, students will learn how to use SD to model and analyze basic electromechanical and hybrid systems. Advanced topics, including simulation-based optimization and application of SD in modeling interdependent infrastructure, socio-economic, and hybrid renewable energy systems, are covered to provide students with an insight to the applications of SD in studying contemporary issues.

SYSEN 536: Decision and Risk Analysis in Engineering

3 Credits

Analysis of engineering decisions under uncertainty; problem identification, formulation, judgment, resolution; mitigation, risk analysis, quantification and management. SYSEN 536 Decision and Risk Analysis in Engineering (3) This course examines the analysis of decisions under uncertainty within the context of engineering and technology. It focuses on understanding and improving the decision-making process of individuals and groups in technical organizations. Emphasis is placed on evaluation methods; identification, modeling, and problem resolution; consequences/outcomes of the action taken; risk analysis and quantification. Objectives 1. To appreciate the theoretical foundations of decision sciences within the context of engineering data and problems. 2. To be able to explain and evaluate alternative perspectives of the decision making process. 3. To be able to identify sources of decision failure in individuals and organizations. 4. To gain an understanding of decision technologies in the context of engineering decision making. Performance will be evaluated through a mid-semester written examination, homework (case studies) assignments, class participation, and a semester group project with an in-class presentation.

SYSEN 552: Creativity and Problem Solving II

3 Credits

Theory and practical applications of group problem solving, including cognitive gap, coping behavior, agents of change, and managing cognitive diversity. SYSEN 552 Creativity and Problem Solving II (3) This course builds on an understanding of the individual problem solver to address the dynamics of group problem solving, with a particular focus on the domains of science, engineering, and technical management. At the core of the course material is cognitive gap, i.e., differences in cognitive characteristics that may exist between problem solvers (both individuals and groups) and/or between problem solvers and the problems they solve. Students will explore the impact different cognitive profiles on problem solving from multiple perspectives, including group efficiency, personal communication, and the quality of group outcomes. Strategies and tactics for improving the problem solving performance of groups of all sizes will be learned and applied using real-world examples and case studies. Upon completing this course, students will have a fundamental, rigorous understanding of cognitive diversity within groups and how it can be leveraged to make problem solving more effective. Skills learned will include: analyzing the cognitive resources of a problem solving group; breaking down complex problems based on cognitive variables; and matching cognitive resources appropriately with required skills. With its focus on effective problem solving at the group level, this course is appropriate for students in all disciplines and areas of study. It also serves as the foundation for additional courses in problem solving, which may build upon the theoretical elements presented here (e.g., problem solving leadership) or serve as in-depth application studies in specific topical areas (e.g., invention). Students' performance in this course will be evaluated through written examinations and homework assignments, as well as class participation. This course will be offered at least once each academic year.

Prerequisite: SYSEN550**SYSEN 554: Problem Solving Leadership**

3 Credits

Models, processes, and techniques for solving complex problems, managing problem solving diversity, and facilitating change through problem solving in socio-technical systems. SYSEN 554 Problem Solving Leadership (3) As the problems faced by professionals become more complex, expertise in the domain of the problem must be supplemented with knowledge about the problem solver and the problem solving process. This course builds on an understanding of the individual problem solver and problem solving groups (and the individual's role within them) to focus on the facilitation of complex problem solving within socio-technical systems, including the role of the problem solving leader within problem solving groups. Students will learn and implement strategies for characterizing and coordinating the problem solving preferences and abilities of individuals and groups based on problem constraints and the solutions desired. Other topics and skill sets covered will include: systems models of leadership; practical leadership as problem solving; processes and techniques for characterizing complex needs, generating and assessing potential solutions, and evaluating problem solving outcomes; frameworks for modeling and coordinating problem solving diversity among people, problems, and products; and the modeling and facilitation of socio-technical change through problem solving. This course is appropriate for students in all disciplines and areas of study, although it is particularly relevant for students in engineering, science, and/or management. Students' performance in this course will be evaluated through written examinations, homework assignments, and a class project that extends over the semester.

Prerequisite: SYSEN550 , SYSEN552**SYSEN 555: Invention and Creative Design**

3 Credits

This course focuses on the creative design process which leads to the development of new products, processes, and systems (i.e. invention).

SYSEN 594: Research Topics

1-15 Credits/Maximum of 15

Supervised student activities on research projects identified on an individual or small-group basis.

SYSEN 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

SYSEN 805: Technical Project Management

3 Credits

Analysis and construction of project plans for the development of complex engineering products taken from a variety of problem domains.

SYSEN 850: Creativity & Problem Solving I

3 Credits

The primary objective of this course is to help students become better and more effective problem solvers through a basic, yet rigorous, understanding of the cognitive processes involved in problem solving

and individual creative behavior. To meet this objective, selected elements of cognitive psychology are examined, along with general and domain-specific models of the problem solving process, a variety of problem solving techniques, and illustrative examples and case studies related to these topics in a variety of contexts (including science, engineering, and management). In addition, students will explore their personal preferences for problem solving strategies and the ways these preferences can impact both personal and professional life. Here, the objective is to provide students with an assessment of their strengths and weaknesses in the domain of problem solving, as well as a basis of understanding and appreciating the diverse problem solving abilities and styles of others. With its focus on effective problem solving at the individual level, this course is appropriate for students in all disciplines and areas of study. It also serves as the foundation for additional courses in problem solving, which may build upon the theoretical elements presented here (e.g., group problem solving) or serve as in-depth application studies in specific topical areas (e.g., invention).

SYSEN 880: Systems Architecture and Models

3 Credits

System architecture is an abstract view of a complex system distinct from the details of how such a system is implemented. It plays a significant role in developing complex systems that meet expectations of their stakeholders and achieve the mission and life cycle concepts of the system. This course covers the fundamental concepts, techniques, and methods for creating and analyzing system architecture of complex systems. System engineers, system architects, product design engineers, product managers, and project managers working in system development of commercial or military engineering systems will benefit from this course. Major topics to be covered include analysis of form and function, the process of mapping form to function, and methods of decomposition and re-integration, application of model based systems engineering for development and analysis of system architecture, and view-based architectural frameworks for documentation of system architecture. Students will: - Learn the significance of system architecture, - Learn fundamental concepts underlying a system architecture, - Learn models, methods, and tools for architecture development and analysis, - Demonstrate understanding of influences on system architecture decisions - Explore architectural frameworks for documentation of system architecture

SYSEN 895: Internship

1-9 Credits/Maximum of 9

Supervised, professionally oriented, off-campus, nongroup instruction, including field experiences, practicums, or internships.

SYSEN 897: Special Topics

1-9 Credits/Maximum of 999

Formal courses given on a topical or special interest subject which may be offered infrequently.

Theatre (THEA)

THEA 500: Theatre Research: Sources and Procedure

3 Credits

Source materials and techniques as applied to theatre research; the form and content of theses and monographs.

THEA 501: Dramaturgy Seminar

3 Credits

Emerging theatre artists necessarily focus on skill, craft, and presentation. This course proposes a parallel path of artist-scholarship to enrich the student's portfolios, communities, and fields. Focusing on writing and presentation, students experience research as a dramaturg might; that is, as a rigorous but practical approach to scholarship.

THEA 502: Creative Collaboration

3 Credits

Theory and process of creative collaboration between the theatre artistic and production staffs.

Prerequisite: MFA theatre candidate

THEA 503: Theatre of the Americas

3 Credits

This course is an exploration of American theatre, in South, Central and North America, and the points of connection and conflict between European theatrical styles, indigenous and diasporic cultures, and governmental and anti-governmental performance. Through encounters with plays, primary sources, and current scholarship, students will investigate the varied meanings of the contested term 'American' and discover theatrical practices of other times, cultures and artists that were used to create art that engaged with questions of defining and redefining the American theatre.

THEA 504: Modernism and Postmodernism in the Theatre

3 Credits

This is a course in 20th-21st century modernism and postmodernism in the theatre. It surveys evolving modernist/postmodernist theatre practices in their cultural and intellectual contexts, paying particular attention to the aesthetic evolution from one artistic philosophy to the next. Along the way Naturalism, Symbolism, Futurism, Expressionism, and Dada are explored, as well as Marxism, Structuralism, Poststructuralism, Orientalism, Postcolonialism, and several other theatrically influential aesthetic and theoretical ISMs. Course readings include plays, manifestos, and aesthetic theories. Course methodology focuses on explication of historical performances and their relationship to the social and political circumstances in which they occurred.

Recommended Preparations: THEA 501; THEA 803

THEA 505: Masterpieces in Production I

3 Credits

Dramatic structure, theatrical validity, production viability of great plays from Greek to eighteenth-century. Drama as blueprint for production.

THEA 506: Masterpieces in Production II

3 Credits

Dramatic structure, theatrical validity, production viability of masterworks of theatre. Drama as the blueprint for production. Offered in London, England. THEA 506 Masterpieces in Production II (3) This course functions as a component of the core sequence on text analysis and dramatic literature required of all graduate students in the School of Theatre. As the course is offered only in London, England, it also functions as a core component of the international field studies program. While in residence at University Park, the focus of the course will be on literature and theory. Graduate students will then take up residence in London, England, where they will experience and analyze plays in production, focusing on production techniques and application of theory in the real world of the theatre.

Prerequisite: THEA 500 , THEA 505

THEA 507: Masterpieces in Production III

3 Credits

Dramatic structure, theatrical validity, production viability of major American plays from Tyler to the present. Drama as blueprint for production.

THEA 508: Experiential Analysis of Italian Design Styles

3 Credits

Applications of Historical and Cultural Perspectives in Dramatic Production. Offered in Italy.

THEA 509: Experiential Analysis of Eastern European Styles

3 Credits

Applications of Historical and Cultural Perspectives in Dramatic Production. Offered in Prague and Budapest.

THEA 510: Experiential Analysis of Period Style

3 Credits

Applications of Visual/Spatial History in Dramatic Production. Offered in London, England. THEA 510 Experiential Analysis of Period Style (3) This course is taught in tandem with the second course of the core sequence on text analysis and dramatic literature required of all graduate students in the School of Theatre. As the course is offered only in London, England, it also functions as a core component of the international field studies program. Prior to taking up residence in England, students will explore films and dramatic texts set in periods ranging from the middle ages to the present day. Discussion will focus on the historic context for each dramatic work. Topics covered will include background information on historical events, an introduction to the visual world of each period, and the social/cultural ideology reflected in the period design. While in England, students will participate in tours of museums and historical sites. Class discussion will focus on establishing connections between the social/cultural content previously presented and the tactile, spatial experiences gained through seeing actual sites and artifacts from each period. The primary objective of the course will be to enhance the practical and intuitive understanding of period dramatic action in theatre students of all disciplines by guiding them through actual experience of period artifacts and spaces.

THEA 524: Acting V

2 Credits

Advanced scene study and class projects; development of individual student repertoires.

Prerequisite: THEA 523A

THEA 529: Performance Monograph

1-2 Credits/Maximum of 4

The development and presentation of M.F.A. monographs in acting, design/ production, or directing.

Prerequisite: permission of graduate supervisor

THEA 530: Rehearsal Methods for the Director

3 Credits/Maximum of 3

Theory and practice in approaches, procedures, and techniques in mounting a play.

Prerequisite: THEA 410 , THEA 434 , permission of instructor prior to registration

THEA 531: Directorial Styles and Approaches

2 Credits

Seminar in advanced theory and directorial practice. Designed for the advanced student of directing.

Prerequisite: THEA 530

THEA 532: Directing Seminar

2 Credits

Career orientation: resume preparation, interviewing, unions, survey of directorial opportunities, and review of major contemporary directors and practices.

Prerequisite: THEA 531

THEA 539: Projects in Directing

1-2 Credits/Maximum of 2

Approved directing projects for the M.F.A. directing student.

Prerequisite: THEA 410 ; admission to the M.F.A. directing program

THEA 543: Projects in Playwriting

1-9 Credits/Maximum of 9

Preparation of the script for revision during and following production of the student's original play.

Prerequisite: production approval

THEA 553: Scene Design IV

3 Credits

Design of plays for proper theatre and mass media.

Prerequisite: THEA 552 , MFA theatre design candidacy

THEA 559: Portfolio Presentation

1 Credits/Maximum of 2

Current practice in portfolio development and presentation to client and employer.

Prerequisite: prior approval of faculty

THEA 569: Costume Construction: Crafts

3 Credits

Exploration and development of various crafts techniques with application to costume construction (i.e. masks, jewelry, armor, millinery, footwear, wigs).

THEA 571: Stage Lighting Design IV

3 Credits

Course addresses individual problems in the stage lighting design process concentrating on the development of skills necessary for professional examination.

Prerequisite: THEA 570

THEA 585: Theatre Planning

3 Credits

Processes and problems in planning and designing theatres: performance, audience, and technical requirements.

THEA 589: Design/Production Monograph

1-4 Credits/Maximum of 4

The development and presentation of M.F.A. monographs in design/production.

THEA 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

THEA 595: Internship

1-3 Credits/Maximum of 3

Professional field experience in theatre performance, production, and management assignments.

Prerequisite: approval of internship by instructor prior to registration

THEA 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

THEA 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

THEA 597A: ****SPECIAL TOPICS****

1 Credits

THEA 597B: ****SPECIAL TOPICS****

6 Credits

THEA 597C: ****SPECIAL TOPICS****

3 Credits

THEA 597D: ****SPECIAL TOPICS****

3 Credits

THEA 597F: ****SPECIAL TOPICS****

2 Credits

THEA 597G: ****SPECIAL TOPICS****

2 Credits

THEA 597I: ****SPECIAL TOPICS****

1-3 Credits

THEA 597K: ****SPECIAL TOPICS****

3 Credits

THEA 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

THEA 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Teaching of theatre and film classes under senior faculty supervision.

THEA 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

THEA 803: Pedagogy Seminar

3 Credits

Each generation of theatre artists, technicians, and scholars trains the next generation. This seminar has two goals: 1) to cover the nuts and bolts of preparing and teaching a theatre course, and 2) to do so in a way that proceeds from personal artist/citizen values. These two goals can be difficult to reconcile. Many if not most theatre instructors learn from key teachers of practice who teach the skills they know. This is one necessary dimension of teaching-imparting knowledge-but this course stretches the idea of teaching beyond this idea. The goal of this course is for students to discover how they fit into the field as a teacher and

scholar, and how they might develop a portfolio of materials to be a successful job candidate and a successful teacher.

THEA 811: International Studio Intensive

1-9 Credits

The course enhances the ability of the actor to meet the voice and speech demands for the performance of Shakespeare. THEA 811 International Studio Intensive (1-9 per semester) The objective of the course is two-fold. The first part of the class deals with the vocal skills necessary for successful acting of the Shakespearean play. The actors work on a series of rigorous voice and speech exercises, and master an intense and complete warm-up that prepares them to deal with the text. The second portion of the course deals with the play-script itself and examines the relationship between the voice and the text. Working with sonnets and monologues, the student is introduced to scansion, imagery, alliteration, and other text related skills.

THEA 811A: International Production Studio Intensive

1-9 Credits/Maximum of 9

Intensive studio application of processes and procedures within specific theatre disciplines as influenced by the work of international professionals.

Prerequisite: THEA 500 , THEA 505

THEA 820A: Acting I

4 Credits

Exercises, monologue, and scene study. Principal focus on realism. THEA 820A Acting I (3 per semester) THEA 820A is a laboratory or practicum course requiring active student presentation of assigned acting projects. Outside preparation and homework are required for all sessions. Working in pairs, each student will participate in improvisational scenes on a daily basis. In addition, each actor will be required to independently prepare and present various acting exercises, scenarios, and finally, a comprehensive play and character analysis for a scripted scene from contemporary realism (that will be performed with an acting partner the following semester). Critiques of each actor's work will be given on a daily basis and the student will be expected to rehearse outside of class to address any issues raised and to have them remedied for the next viewing.

Prerequisite: admission to the MFA performance acting program

THEA 820B: Movement for Actors I

2 Credits

Techniques and skills in physical expression, awareness, control, and stage movement. THEA 820B Movement for Actors I (2 per semester) A fundamental movement class designed to strengthen, prepare, and align the body for maximum freedom of expression. Emphasis is on concentration, flexibility, balance, coordination, relaxation and sensitivity to the impulses stimulated from outer and inner resources. Techniques may include but are not limited to time tested modalities such as Yoga, Alexander, Tai Chi, Pilates, Feldenkrais, and Modern Dance. Included in the course are units on nutrition, time management, and the proper care and maintenance of the physical instrument. Students will be evaluated according to their acquisition of skills and professional attitude.

Prerequisite: admission to MFA performance acting program

THEA 820C: Voice and Speech I

2 Credits

Vocal techniques for the actor: articulation, voice control, support, and projection. THEA 820C Voice and Speech I (2) THEA 820C is the first in a sequence of voice and speech courses for the actor. This first semester installment will focus on awareness and conditioning activities related to breath, posture, resonance and articulation. Prose and poetry readings will be used for application activities. Students will experience activities that will heighten their physical awareness of vocalizing. Most activities will involve a re-learning of how they speak, bringing to their conscious awareness the processes of voice/speech which were initially learned through early childhood nurturing. Class events will include awareness of breath patterns and the means to release inhibitive behaviors related to spinal posture, head and neck alignment, and musculature along the breath/vocal tract. Students will also gain awareness of how breath relates to their expressive/emotional system.

Prerequisite: admission to the MFA performance acting program

THEA 821A: Acting II

3 Credits

A continuation of THEA 520A. THEA 821A Acting II (3) The foundational work of the first semester continues with its application to scripted material, primarily drawn from contemporary drama. The actor's skills in contact, communication, and inventiveness are further developed, along with personalizing the given circumstances of the dramatic text. The concept of character: is introduced and students will begin the exploration of bringing truthful behavior to viewpoints different than their own. Each student will be paired with an acting partner and perform three scenes during the semester. A written, comprehensive script and character analysis will be required for each scene. Critiques of each actor's work will be given on a daily basis and the student will be expected to rehearse outside of class to address any issues raised and to have them remedied for the next viewing.

Prerequisite: THEA 820A

THEA 821B: Movement for Actors II

2 Credits

A continuation of THEA 520B. THEA 821B Movement for Actors II (2) Through the study and discipline of learning precise corporeal skills, the actors gain confidence and clarity of expression. This clarity is applied toward the creation of mimetic illusions, mask-work, tableaux, and various animal and effort shaping studies aimed at developing characters for the stage. Characters may range from the fantastic to the most real. Improvisation and specific exercises are developed to encourage bold physical choices and the liberation of the creative imagination. Actors work in individual, team, and ensemble situations to apply techniques toward meaningful rendition of ideas.

Prerequisite: THEA 820B

THEA 821C: Voice and Speech II

2 Credits

A continuation of THEA 520C. THEA 821C Voice and Speech II (2) THEA 821C is the second in a sequence of voice and speech courses

for the actor. This second semester installment will continue the focus of voice/speech training addressed in THEA 820: focus on awareness and conditioning activities related to breath, posture, resonance and articulation. Prose and poetry readings will be used for application activities. Students will experience activities that will heighten their physical awareness of vocalizing. Most activities will involve a re-learning of how they speak, bringing to their conscious awareness the processes of voice/speech which were initially learned through early childhood nurturing. Class events will include awareness of breath patterns and the means to release inhibitive behaviors related to spinal posture, head and neck alignment, and musculature along the breath/vocal tract. Students will also gain awareness of how breath relates to their expressive/emotional system. Class activities will also include physical awareness of the consonant and vowels sounds and their phonetic transcriptions. Each event will strive to improve actors' intelligibility and increase musicality of speech. Through application assignments with word lists, sentences, poetry and prose, students will increase language sensitivity. This semester will also address voice quality issues directly and how they relate to the above. Specific events will focus on vibratory awareness in primary resonators and how to apply this awareness in all vocal life. Issues of vocal health, projection and emotional demands will be addressed. Students will be evaluated upon preparedness, work ethic, focus, openness to change, growth, degree of self-reliant recall and creative application of new skills. This studio performance class offers opportunity for assessment from the instructor in each class session. Periodic assignments will be made to assess self-reliant application of the work.

Prerequisite: THEA 820C

THEA 822A: Acting III

3 Credits

This course will focus on the research and development of skills necessary to perform the plays of Shakespeare and his contemporaries. THEA 822A Acting III (3) THEA 822A is designed to take the skills acquired in the movement, voice and acting studios in the first year of the graduate actor training program and apply them to the lush words, passionate images, and intense emotion required by the elevated texts of playwrights such as Shakespeare. The process requires the reduction of modern vocal and physical parasites and their replacement by a higher standard of speech and a classically open, expressive body. Truthful behavior in action is still the goal - the challenge is to embrace Shakespeare's truths. In the weeks devoted to scene study, the actors must learn to be comfortable with classical works, to confront any predisposition about style, and see that their vocal and physical instruments need to be strengthened in order to fully play classical characters. Because THEA 822A is a laboratory performance course, one in which students must be sharing what they are learning or performing on a daily basis, on-going assessment takes place through faculty feedback in working sessions, through faculty and peer critique of work presented, through an oral evaluation at mid-semester in conference with the graduate acting faculty, and through an extensive written evaluation and formal conference with the head of the School and the head of the acting program at semester's end. Other faculty will observe midterm and end of semester presentations to offer insights. Students thus receive assessment on many occasions in the course of the semester.

Prerequisite: THEA 821A

THEA 822B: Movement for Actors III

2 Credits

Advanced techniques and skills in physical expression. THEA 822B Movement for Actors III (2) Building upon the character work of the previous semester, actors delve into the specific demands of farcical comedy and the development of European clown characters. Comic devices, timing, exaggeration, and invention are studied and applied to specific texts dealing with farcical movement demands. Clown characters are devised and guided toward specific invention work aimed at developing skills needed for a wide variety of comic situations. Building upon the previous work, an ensemble improvisation piece is developed to enable actors to apply techniques to an invented world with many different and demanding situations. Linking to the classical work in the acting studio, the actors will finish with a unit dealing with comic and dramatic physical demands and pitfalls inherent in working within the world of Shakespeare's plays.

Prerequisite: THEA 821B

THEA 822C: Voice and Speech III

2 Credits

Advanced voice and speech training for the actor: articulation, resonance, and vocal technique related to verse and heightened language drama. THEA 822C Voice and Speech III (2) THEA 822C is the third in a sequence of voice and speech courses for the actor. This third semester installment will focus on review of speech and voice techniques and application of those techniques in the performance of Shakespearean drama text and other heightened language plays. Scansion of poetic meter, syntax, lexicon resources, and sound patterns will be the primary informative elements of vocal performance. Students will be assigned sonnets, monologues and scenes as vehicles for application in the studio. Students will be evaluated upon preparedness, work ethic, focus, openness to change, growth, degree of self-reliant recall and creative application of new skills. This studio performance class offers opportunity for assessment from the instructor in each class session. Periodic assignments will be made to assess self-reliant application of the work.

Prerequisite: THEA 821C

THEA 823A: Acting IV

3 Credits

Students prepare audition material for their New York Showcase for theatrical agents. THEA 823A Acting IV (3) The objective of the course is the selection, rehearsal, and performance of audition material for the New York Showcase for theatrical agents. Students begin the semester by bringing large amounts of potential audition material into a peer review format where their fellow students and the instructor, evaluate the monologues and scenes and give specific feedback on its suitability. During the course of the semester, the students decide on a core of eight monologues and four scenes from which the final Showcase will be crafted. The monologues are performed for the class and the School of Theatre faculty.

Prerequisite: THEA 822A

THEA 823B: Movement for Actors IV

2 Credits

Fundamentals of unarmed and armed stage combat with emphasis on enactment of safe and effective stage fights. THEA 823B Movement for Actors IV (2) Actors learn the basics of unarmed and armed stage combat techniques. Applying the standardized and time-tested safety measures derived from the Society of American Fight Directors, each actor must master kicks, slaps, punches, grabs, holds, rolls, and all other unarmed techniques. They must also learn how to wield a quarterstaff, rapier and dagger, and broadsword with confidence: safely and effectively enacting various styles of stage combat choreography. Designed to train specific techniques while raising kinetic awareness, the course also introduces the historical background for each weapon style.

Prerequisite: THEA 822B

THEA 823C: Voice and Speech IV

2 Credits

A study of stage dialects. THEA 823C Voice and Speech IV (2) THEA 823C is the fourth in a sequence of voice and speech courses for the actor. This fourth semester installment will apply the articulation, phonetics and resonance skills addressed in prerequisite classes toward the acquisition of stage dialects and accents. For each dialect the student becomes aware of the resonance, phonetic transcription, inflection, and rhythmic changes necessary to perform dramatic text with an accent or dialect. Vocal agility, phonetic recall and the ability to integrate the altered vocal behavior to the demands of acting are the primary goals. Each dialect unit will have an introductory instruction, a review session, and a presentation of a reading of a dialect monologue. The final project will be the performance of two dialect monologues. Students will be evaluated upon preparedness, work ethic, focus, openness to change, growth, degree of self-reliant recall and creative application of new skills. This studio performance class offers opportunity for assessment from the instructor in each class session. Periodic assignments will be made to assess self-reliant application of the work.

Prerequisite: THEA 822C

THEA 824: Acting for the Camera

6 Credits

This course introduces the actor to the skills necessary for successful performance in television, film, video and commercial venues.

Prerequisite: THEA 823A , THEA 823B , THEA 823C

THEA 825A: Acting Professionally/NYC Showcase

3 Credits

Development of audition repertoire; study of business topics; development, rehearsal and performance of NYC showcase. THEA 825A Acting Professionally/NYC Showcase (3) THEA 825A is a capstone course that brings closure to the actors' studio training and prepares them for entrance into the competitive world of the entertainment industry. The first half of the semester the students will locate, edit and present audition material for weekly critique. The students will also become aware of business practices related to the acting profession such as union membership, contracts, working with agents/casting directors, etc. During the second eight weeks the students will rehearse and eventually perform an audition showcase in NYC for talent agents and casting

directors. Students will receive daily criticism of their work by faculty and peers and will be graded upon the applied aspects of the course, in audition tour of professional regional theatres and the NYC showcase performance.

Prerequisite: THEA 823A , THEA 823B , THEA 823C

THEA 825C: Professional Repertory Performance

3 Credits

Rehearsal and performance of theatre productions at Penn State featuring third year MFA actors and professional guest artists. THEA 825C Professional Repertory Performance (3) The professional performance experience is the equivalent of a masters degree thesis. It is the culminating event for three years of full-time study, rehearsal, and performance. The season is chosen to demonstrate the acting skills of each student in the third year of the M.F.A. program. These plays are chosen to be the first professional experience for the acting students as they work alongside professional guest artists.

Prerequisite: THEA 823A , THEA 823B , THEA 823C

THEA 830: Interdisciplinary Theatrical Design Studio

3-6 Credits/Maximum of 36

Advanced analysis, graphic, and presentation techniques for evolving and communicating design for the stage.

THEA 831: Theatrical Costume Technology Studio

3-6 Credits/Maximum of 6

Advanced mastery of both traditional and modern techniques in costume creation for live performance This course will combine the instruction of all aspects of theatrical costume execution for the stage into a single studio. Upon completion of diagnostic exercises, costume faculty will work with students, providing project based instruction specific to the student's developmental level and necessary industry skill sets. Innovative methodologies and new technologies are also explored. This course will encourage a professional standard in skills and techniques, and promote a greater understanding of the creative and collaborative relationship between the technologist, costume designer, and performer.

THEA 840: Music Directors Studio

3 Credits/Maximum of 18

This is the core foundation studio for the music direction area of the MFA in Theatre. It involves small group and individual instruction, in which every skill and knowledge set necessary to the professional theatre music director is developed to a professional standard, through discussion, practice, and practicum in the form of membership in the music staff of a Centre Stage musical.

THEA 841: Music Direction for Musical Theatre 2nd/3rd-year Studio

3 Credits/Maximum of 6

The student will spend half of each semester coaching and accompanying 2nd-year musical theatre undergraduates in their Acting the Song studio course, and the other conducting and music directing 3rd-year musical theatre undergraduates in their Musical Theatre Ensemble studio course.

THEA 842: Music Direction for Musical Theatre 4th-year Studio

2 Credits

This course introduces the graduate music director to some of the behind-the-scenes work that goes into creating and rehearsing musical material for special events or individual performers, including instrumental arranging, musical theatre notation conventions and techniques, and working with musical theatre performers to create, rehearse and perform bespoke arrangements.

THEA 857: Scenic Design for Production

1 Credits/Maximum of 6

Design and execution of production design projects.

THEA 861: Costume Design and Construction

1-6 Credits/Maximum of 18

Advanced special projects for the graduate designer and costumer.

Prerequisite: THEA 461 or THEA 560

THEA 863: Costume Construction: Draping

3 Credits

Exploration and development of various draping techniques with application to costume construction.

THEA 865: Costume Construction: Period Reconstruction

3 Credits

Exploration and development of reproduction techniques relating to period clothing, and their application to costume construction.

THEA 866: Costume Construction for Production

1 Credits/Maximum of 6

Execution of production in construction and shop management.

THEA 867: Costume Design for Production

1 Credits/Maximum of 6

Design and execution of production design projects.

THEA 877: Lighting Design for Production

1 Credits/Maximum of 6

Design and execution of production design projects.

THEA 890: Colloquium

1-3 Credits/Maximum of 6

Continuing, professionally oriented seminars that consist of a series of individual lectures by faculty, students, or outside speakers.

THEA 895: Internship

1-15 Credits/Maximum of 15

Supervised, professionally oriented, off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

THEA 896: Individual Studies

1-9 Credits/Maximum of 12

Creative projects with a professional orientation, including non-thesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

THEA 897: Special Topics

1-9 Credits/Maximum of 18

Formal courses given on a topical or special interest subject with a professional orientation that may be offered infrequently.

Training and Development - CA (TRDEV)

TRDEV 503: Performance Consulting

3 Credits

Performance consulting strategies and techniques for working with organizations to systematically identify performance problems, diagnose causes, and specify solutions. TRDEV 503 Performance Consulting (3) This course involves the study of performance consulting strategies and techniques when working with organizations to systematically analyze and improve performance at the organization, process, and job levels. This type of consulting involves working with clients to document how work is accomplished at the organization, process, and job-performer levels; selecting appropriate measures of performance for these three levels of performance; and identifying causes of performance problems. As a result of these processes, appropriate solutions can be identified and implemented within a specific organization.

Prerequisite: TRDEV460

TRDEV 505: Project Management in Training and Development

3 Credits

Introduces skills for managing complex training and development projects, such as developing timelines, creating budgets, and allocating resources. TRDEV 505 Project Management in Training and Development (3) In today's fast-paced workplace, training and development professionals must effectively manage complex projects. This course is designed to enhance students' skills in managing a TRDEV project: a) Conceptualizing the project's scope b) Creating and monitoring a realistic timeline for management and completion of the project c) Identifying and allocating necessary resources and personnel d) Creating and monitoring a realistic project budget e) Creating and managing a TRDEV project team

Prerequisite: TRDEV460 , or permission of the program

TRDEV 507: Program Evaluation

3 Credits

Evaluation of educational and other human services programs; preparation and presentation of the evaluation proposal.

Prerequisite: TRDEV460 , or permission of program

TRDEV 518: Systematic Instructional Design in Training

3 Credits

Study of theory and practice of systematic instructional design. Application of instructional design principles to training problems in local organizations.

Prerequisite: TRDEV460 , or permission of program

TRDEV 520: Learning Styles and Learning Theory in Training

3 Credits

Adult learning theory and its application to training and development.

Prerequisite: TRDEV460

TRDEV 528: Instructional Systems Design Applications

3 Credits

Advanced instructional systems design theory, models, strategies, and consulting approaches. TRDEV 528 Instructional Systems Design Applications (3) The ways in which employees work and learn in organizations are continuously changing. Such changes require that instructional designers modify and, when necessary, use new theories and models to be more responsive and effective in meeting organizational needs for learning and performance improvement systems. Introductory graduate courses in instructional systems design typically use traditional models of instructional design to teach graduate students the fundamentals of the design process. This is necessary so that students have a solid foundation of concepts and principles to guide their practice in instructional design. This course, TRDEV 528, immerses students in the instructional systems design literature for the purpose of advancing their knowledge of more contemporary theories, models, and research of instructional systems design as students also engage in a real-world instructional design project. The process of individual and group reflection on recent research and theoretical developments in instructional systems design as students grapple with the demands and challenges of a real-world design project will broaden and deepen their expertise in the instructional systems design, thereby producing instructional designers who are more prepared to responsively and effectively address complex learning and performance improvement needs in organizations.

Prerequisite: TRDEV460 and TRDEV518

TRDEV 530: Multiplatform Delivery Skills

3 Credits

Platform skills for training delivery, including voice, audio-visual aids, and personal presence, in face-to-face and virtual environments. TRDEV 530 Multiplatform Delivery Skills (3) This highly participatory course is designed to provide students with the theoretical underpinnings of communication through presentation that will increase their capacity to flexibly convey content in ways that engage their audience in any

modality - face to face, virtual, synchronous, and asynchronous.

Within the context of solid communications theory, students will have opportunities to develop or strengthen a personal delivery style, applying theoretical constructs to accentuating their strengths. Through readings, discussion, critique of exemplars, practice presentations, and feedback, students will become facile with identifying theory in use, and develop the skills required to effectively deliver content. In the increasingly complex world, there is a persistent need for and value in face-to-face presentations and the skills required to produce and deliver them are paramount in a range of organizational circumstances including but not limited to what is considered formal training. Increasingly, these skills are being called into service to support content delivery in virtual settings, and although the basic approaches are consistent philosophically, these settings require special consideration. It is on this basis that the course is organized into three sections focused on 1) underpinning communications and cognitive theory, 2) application of theory to face-to-face presentations, 3) theoretical distinctions to support virtual environments, both synchronous and asynchronous.

Prerequisite: TRDEV460

TRDEV 531: Technology in Training

3 Credits

Applications of various new instructional technologies to training problems.

Prerequisite: permission of the program

TRDEV 532: Web-Based Training

3 Credits

Introduction to the design and development of websites for computer-based instruction in the workplace. TRDEV 532 Web-Based Training (3) Computer-Based Training (CBT), Computer-Assisted Instruction (CAI), Computer-Based Education (CBE), Interactive Multimedia (IMM), and Web-Based Training (WBT) are all terms used to describe the delivery of learning materials via computer. The recent rapid increase in these types of programs can be partially attributed to the development of software authoring tools. These allow developers to create computer-based programs through easy-to-learn Graphical User Interfaces (GUIs) without requiring extensive knowledge of programming and programming languages. Most recently, the World Wide Web (WWW) has offered a way of distributing training materials through a broader electronic network. Thus, Web-Based Training, or WBT, is becoming increasingly important as a tool for Trainers. Its "language" is primarily HTML. The primary goal of this course is for you, the student, to demonstrate competency in applying design theory while using Web tools to develop a WWW-based module.

Prerequisite: permission of the program

TRDEV 537: Technologies in Learning and Development

3 Credits

Design and application of various technologies utilized for instructional and human resource development in corporate and similar settings. TRDEV 537 Technologies in Learning and Development (3) Over the past several decades, technology has become increasingly important for instruction and organizational development activities in a wide range of corporate and similar settings. While historically focused on relatively straightforward hardware-based implementation (e.g., film and slide

projectors, overhead projectors, etc.), technology is now composed of an increasingly complex combination of hardware and software as well as personally created and/or globally available information. This course will be composed of three distinct, but related areas – distance education, Web-based instruction, and organizational development. The distance education component will include topics related to the various technologies and strategies related to the delivery of instructional materials to students who choose to learn at a distance from their educational institution. Further discussion will include material related to the growing body of research in this field as well as methods for evaluation and assessment. The second major component – Web-based instruction – will focus on the history and research of this rapidly changing area as well as the growing number of technologies available for teaching students who are utilizing this medium for instruction. Topics related to the design and development of instructional materials, including their related technology options, will also be included. The use of various technologies for organizational development is the final major component of this course. These include technologies for knowledge management, organizational diagnosis, career management and succession planning, and collaboration.

Prerequisite: TRDEV460 and TRDEV531

TRDEV 561: Facilitation Theories and Practice

3 Credits

Exploration of facilitation theories and their implications for practice. TRDEV 561 Facilitation Theories and Practice (3) Facilitation is distinct from other forms of group work such as presentation and teaching. It draws on theory and practice from a range of traditions such as adult learning, psychotherapy, group dynamics, action research, and group process consulting to inform unique and flexible approaches to goals that are often unstructured and connected to problem resolution, innovation, and social action. Rather than teach or conduct action, facilitators support the group as members work together to achieve their goals, creating a space for the work without interjecting their own opinions or agenda. Facilitators remain sensitive to myriad real-time details, member participation and group dynamics, the roles of power and culture, and the need for a balance between action and reflection in the work of the group. Good facilitators relinquish control of the group in ways that foster open, balanced dialogue and a spirit of play among group members, building members' capacity for work on subsequent issues and opportunities. Students will actively explore the process of facilitation from the inside out, including facilitator self-awareness, goal and role clarity, developing psycho-social spaces, group process, power, and risk-taking, in both face to face and virtual settings. The course will combine opportunities to actively experiment with applied facilitation both face-to-face and online with feedback, self-reflection, and scholarly research.

Prerequisite: TRDEV460

TRDEV 565: Implementing Training and Development Programs

3 Credits

The critical analysis of theories, strategies, and techniques for planning and implementing TRDEV programs to enhance employee learning and performance. TRDEV 565 Implementing Training and Development Programs (3) A fundamental goal of training and development is to promote employee learning performance. This course involves the critical analysis of theories, strategies, and techniques for planning and

implementing TRDEV programs to support the accomplishment of that goal.

Prerequisite: TRDEV460 or permission of the program

TRDEV 567: Instructional Leadership Theories and Development

3 Credits

Explores instructional leadership theory, development strategies and practice, and style, including students' leadership styles and development action planning. TRDEV 567 Instructional Leadership Theories and Development (3) In this course students will work with three dimensions of instructional leadership. At the core of the course are the key theories of leadership drawn from historic and contemporary scholarship. This will lead into the second dimension, that of leadership development. Perhaps more than any other area of the training and development field, leadership development weaves together the best of what we know about how adults learn and how organizations work, and is arguably one of the most visible strategic contributions influencing groups, organizations, and society writ large. The course will explore the knowledge base and skills necessary to develop leadership in a variety of organizational settings.

Prerequisite: TRDEV460

TRDEV 583: Issues in Training

3 Credits

An issue seminar addressing topics such as an unprepared work force, diversity, recession, and issues generated by the class.

Prerequisite: TRDEV460 , or permission of the program

TRDEV 587: Master's Paper

1-6 Credits/Maximum of 6

The development of an original master's project (paper, production, or practicum) supervised and judged by an appropriate faculty committee.

TRDEV 588: Research Designs Applied in Training

3 Credits

Planning experimental, observation, survey and qualitative research designs for training setting needs such as needs assessments and evaluations.

Prerequisite: EDUC 586 , TRDEV460

TRDEV 590: Colloquium

3 Credits

The purpose of this colloquium is to critically explore current theory, research, and best practices in training and development.

Prerequisite: TRDEV460

TRDEV 595: Internship

1-18 Credits/Maximum of 18

Supervised off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

Prerequisite: prior approval of proposed assignment by instructor

TRDEV 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis and which fall outside the scope of formal courses.

TRDEV 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

Transdisciplinary Research on Environment & Society (TREES)

TREES 574: Integrated Perspectives in Transdisciplinary Research on Environment and Society

3 Credits

Introduction to the integration and application of interdisciplinary concepts to contemporary natural resource and environmental issues.

TREES 575: Ethical Issues in Transdisciplinary Research on Environment and Society

3 Credits

This course foregrounds research in the frontiers of knowledge related to environmental ethics and trans-disciplinary research on the environment and society. It establishes a foundation in key environmental ethics concepts and then helps students develop an interdisciplinary set of ethical, cognitive, reflexive, and professional skills for exploring environmental ethics issues in more detail. As a required course in the TREES dual-title Graduate Program, the course integrates TREES's philosophical and applied approaches to understanding how different value systems in multiple societal contexts influence the management, use, conservation, and preservation of natural resources and the environment. However, the course may also be taken electively by students outside the TREES dual-title program.

Cross-listed with: RSOC 575

TREES 590: Colloquium in Transdisciplinary Research on Environment and Society

1 Credits

Professional socialization and training, development, and assessment of meta-theoretical frameworks and cohort building.

Prerequisite: admissions to the TREES dual-title intercollege degree program

TREES 594: Research Topics

1-18 Credits/Maximum of 18

Supervised student activities on research projects identified on an individual or small-group basis.

TREES 595: Internship

1-18 Credits/Maximum of 18

Supervised, research-oriented, off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

TREES 596: Individual Studies

1-9 Credits/Maximum of 12

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

TREES 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

Traveling Scholars Program (CIC)

CIC 597: Special Topics

1-15 Credits/Maximum of 15

Formal courses taken on a special interest subject which will be offered on a C I C institution by C I C traveling scholars; several different topics may be taken each semester.

Prerequisite: acceptance as a C I C traveling scholar

CIC 598: Special Topics

1-15 Credits/Maximum of 15

Formal courses taken on a special interest subject which will be offered on a C I C institution by C I C traveling scholars; several different topics may be taken each semester.

Prerequisite: acceptance as a C I C traveling scholar

Turfgrass (TURF)

TURF 850: Turfgrass Physiology

3 Credits

Lectures, reading assignments, and problems designed to develop student competency in plant physiology as it relates to turfgrass management strategies. TURF 850 Turfgrass Physiology (3)The emphasis of this course will be on the applied aspects of turfgrass physiology; however, in order for these to be useful in an applied manner, the science behind them must be fully understood so they may be properly implemented. This course is designed to provide turfgrass managers the background knowledge of physiological principles and concepts in order for them to make informed decisions as they implement new technologies in their cultural systems. Basic topics include the physiology of the germination process, seedling development, photosynthesis, respiration, transpiration, seedhead development, and the physiological implications of the use of bio-stimulants, growth regulators, phytohormones, and antioxidants on turfgrass quality. Other topics that will be discussed include; carbohydrate metabolism and utilization, dormancy, and hardening.

TURF 852: Turfgrass Health Management

3 Credits

Lectures and exercises designed to develop student competency in solving turfgrass pest problems, as well as disease resistance in turfgrass.

TURF 853: Interpreting Turfgrass Science Literature

3 Credits

Introduction to turfgrass research publications, interpretation of the data, and discussion of the significance of the results. PPATH (TURF) 853 Interpreting Turfgrass Science Literature (3) This course will provide an introduction to literature search in turfgrass management, identification of most pertinent peer-reviewed journals for each area of interest/specialty in turfgrass management, and utilization of other resources such as technical journals, trade journals, online and resident educational material resources, extension bulletins/circulars from various institutions/organizations that addresses various topics on turfgrass management. This course will prepare the students for analyzing research questions or rationale formulated by an investigator, for understanding how the study was devised to address the objectives adequately and the results were obtained and presented in the publication, and for identifying the take-home message in the publication. Emphasis will be made on the criteria used for data collection, the significance of methods employed in statistical analyses of the data, and presentation of results in the publications to effectively convey the information to readers.

Cross-listed with: PPATH 853

Veterinary and Biomedical Sciences (VBSC)

VBSC 503: Critical Elements of Genetics and Molecular and Cellular Biology

4 Credits

Foundational topics and critical analysis in evolution, genetics, molecular and cellular biology and cell differentiation. BIOL (/BMMB/MCIBS/ VB SC) 503 Critical Elements of Genetics and Molecular and Cellular Biology (4) Central elements in genetics, genomics and molecular and cell biology will be covered. The course will focus on foundational principles and concepts that will allow students to understand the behavior of proteins and organelles within cells, and to appreciate how intracellular events influence interactions of cells with one another in multicellular systems and during development. Another major focus will be genome architecture, both in the context of evolution and gene expression. Students will also learn how genetic approaches can be used to understand cell and molecular biology, and will develop critical thinking skills through the analysis of the primary scientific literature. The course will include lecture and discussion sessions.

Cross-listed with: BIOL 503, MCIBS 503

VBSC 511: Molecular Immunology

2 Credits

The study of molecular and biochemical events that influence immune responses and define current questions in immunology. BMMB 511 /

MCIBS 511 / VBSC 511 Molecular Immunology (2) The goals of the course are to integrate the current questions of immunology with other disciplines, in particular cell biology and biochemistry, and to provide training in critical thinking and evaluation of data and experiments. The course will be approximately 2/3 lecture by the instructor and 1/3 student presentations of papers related to the material. In addition, written critical reviews of recently published papers and a short research proposal will be assigned. By focusing on the mechanisms involved in immunity and disease, this course complements several existing courses on immunology, virology, and biochemistry. The prerequisites of MICRB 410 and BMB 400 assure that the students enrolling in the course have a general understanding of immunology and biochemistry. This course is projected as an elective for the Molecular Medicine and Immunobiology focus areas in the MCIBS graduate program and for the Pathobiology and BMMB graduate programs. The course will be offered in the fall semester with an enrollment limit of 20 students

Prerequisite: B M B400 , MICRB410

Cross-listed with: BMMB 511, MCIBS 511

VBSC 514: Prostaglandins and Leukotrienes

3 Credits

Biochemical, physiological, and nutritional aspects of arachidonic acid and related essential fatty acid metabolism. Structure-activity relationships of prostaglandins, prostacyclins, thromboxanes, and leukotrienes.

Prerequisite: BIOCH402 or BIOCH437

Cross-listed with: NUTR 514

VBSC 520: Pathobiology

3 Credits

This course provides students with opportunities to read, present, and discuss current papers from the scientific literature. The papers will reflect new and innovative methods of studying the molecular mechanisms by which viral and bacterial pathogens infect hosts, evade immune defenses, and cause disease. Additional topics include immunological basis for disease, and new strategies for development of vaccines and therapeutics. Students will learn and evaluate new experimental approaches and techniques, and think critically about data interpretation. The course also provides opportunities for students to develop and refine both scientific writing and oral presentation skills in preparation for graduate-level qualifying and comprehensive exams.

Prerequisite: V SC 420 ; BIOCH401 or BIOCH437

VBSC 534: Current Topics in Cancer Research

3 Credits

A discussion of current cancer research literature with the focus on primary research literature. VB SC 534 Current Topics in Cancer Research (3) Students enrolled in Current Topics in Cancer Research will acquire knowledge of focused areas in cancer research including basic biology of cancer cells, genes and signaling pathways that control cancer cell growth and metastasis, molecular methods for analysis of human and animal cancers, specific animal models of cancer and molecular approaches to cancer therapy. Emphasis will be placed on critical reading of primary literature, identification of strengths and weaknesses of methods, approach and conclusions of specific studies and implications of the research for future studies and understanding of cancer and

therapy. This course will provide a solid foundation and companion for other specialized courses in a diverse group of graduate degree programs as well as the critical thinking and analysis required for completion of a doctoral program.

Prerequisite: BIOL 413 or BIOL 416 or B M B400 or B M B433 or B M B460

VBSC 535: Oncology: Bench to Bedside

3 Credits

This course is required for graduate students in the MCIBS program who are in the Cancer Biology Emphasis Area. It is designed to give students who are studying cancer at a molecular, reductive level experience with the clinical aspects of the disease. The course will be held at Mt. Nittany Medical Center once a week for 3 hrs, in both patient-oriented, hands-on and didactic settings to understand how cancer is diagnosed, imaged, and treated, how patient care and side effects of therapy are managed, and the importance of clinical trials in developing new treatments for cancer. For each subject area students will spend 2 hours engaged in a clinical experience related to cancer under the supervision of course directors or additional clinicians at Mt. Nittany, followed by a 1 hour lecture/didactic session on a related topic. In addition to broad learning objectives, this course will make students aware of critical issues in cancer biology and treatment that may serve as a springboard for future research.

Prerequisite: MCIBS 503, MCIBS 590, BIOL 416; VBSC 534
Cross-listed with: MCIBS 535

VBSC 555: Principles of Metabolomics

3 Credits

Metabolomics is broadly defined as the comprehensive measurement of low-molecular weight molecules present within an organism, cell, or tissue. As a newer -omics technology, it has found applications in a number of disciplines, including biomedical studies, drug discovery, environmental and ecological monitoring, plant biology, toxicology, and food science. This course teaches the general principles of metabolomics studies and analysis. The objectives of this course include: Demonstrate an understanding of the nature of metabolomics investigations and methods that enter into reproducible, rigorous studies; describe the instrumental and chemical considerations involved in gathering robust data; apply uni- and multi-variate statistical analyses to the data; demonstrate an understanding of interpretation strategies and how to relate statistical analyses to the original sample system; and apply knowledge of metabolomics in discussing emerging instrumental and analytical strategies. This course is designed for those interested in incorporating metabolomics analyses into their research programs, as well as those interested in this emerging -omics technology and its applications to human, plant, animal, and environmental systems. While there is no formal prerequisite or requirement for statistics prior to taking this course, it should be understood that a lot of data analysis techniques surrounding metabolomics involves univariate and multivariate statistics. Thus, an understanding of basic statistics is recommended to maximize the benefits of this course. The course will include in-person interaction with both the Metabolomics Core Facility and the NMR Core Facility to gain some hands-on experience on sample submission and operation of the instruments in question.

Recommended Preparations: An understanding of basic statistics and chemical principles is recommended to maximize the benefits of this course

VBSC 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

VBSC 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

VBSC 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

VBSC 597A: **SPECIAL TOPICS**

1-3 Credits

VBSC 597B: **SPECIAL TOPICS**

1-2 Credits

VBSC 597F: **SPECIAL TOPICS**

1 Credits

VBSC 597G: **SPECIAL TOPICS**

1 Credits

VBSC 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

VBSC 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

VBSC 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Experience in preparing and conducting lectures/laboratories and assembling materials for laboratories.

Virology (VIRIM)

VIRIM 580: Critical Reading in Immunobiology

1 Credits

Literature review of cellular, molecular, genetic and biochemical analysis of in vitro and in vivo immunology. VIRIM 580 Critical Readings in

Immunology (1) A critical discussion of primary literature in molecular and cellular immunology to be presented and discussed by students to students participating in this course and faculty of the virology and immunology option of the biomedical and medical sciences (BMS) program. The goals of this seminar format course are twofold. First, students will develop skills in presenting scientific literature to a critical audience of their peers. Second, students will review in depth and critically evaluate current literature in immunobiology, as presented in high impact peer reviewed scientific publications.

Visual Studies (VSTUD)

VSTUD 501: Visual Culture Theory and History

3 Credits

Visual Culture Theory and History examines foundational theoretical texts that have come to define Visual Studies as a historically delineated academic discipline. "Visual Culture Theory and History" provides a broad exploration of theories describing the aesthetic, psychological, and social significance of visual images, as well as the media processes inherent in creating visual experiences. The course will define Visual Studies as an academic field within the humanities. Topics will generally include the image in classical rhetoric, media theories about images, visibility and post-colonial theory, semiotic analysis of images, the cinematic image, gender and visibility, consumer culture's use of images, spectatorship and social identity, television history, images and the construction of space, the relationship between word and image in books, experimental manipulation of visual images in art, images in performance both theatrical and social, the history of photography, and technologies of image production. The class discussions will elucidate the interdisciplinary effects of image production, reception, and circulation in modern media environments. The course will provide students with a broad range of theoretical methods for analyzing visual images so that they may understand their importance and incorporate a theoretically sophisticated analysis of this visual component in their graduate research. The course is one of two required courses for the Visual Studies dual degree.

VSTUD 502: Visual Digitality

3 Credits

Study of historical, theoretical, and operational aspects of the consumption and production of digital technologies and associated cultures.

VSTUD 532: Holocaust and Visual Culture

3 Credits

This course studies how art, literature, film, and other media can provide a perspective on one of the most horrific events in human history, the Holocaust: the genocidal murder of more than six million men, women, and children (mostly Jewish) under the Nazi regime during World War II. The course examines the theoretical questions involved in any attempt to capture what appears to be beyond comprehension in terms of moral outrage and the sheer scale, inhumanity, and bureaucratic efficiency of the violence perpetrated by the Nazis. This course examines formal approaches of depicting the Holocaust in literature and film, as well as photography, museum installations, and memorials. Topics to be discussed include memorialization (Holocaust museums and memorials), mass murder of the disabled, national guilt, survivor's guilt, stigmatization, and the ethics of historical representation. The course will

analyze cinematic strategies for representing the unrepresentable, dark humor about the Holocaust, the persistence of the past, Nazi propaganda, Holocaust photography, trauma theories, graphic novels, the Nuremberg trials, survivor memoirs, representations of the Nuremberg Code and the International Bill of Norms, and possibilities for art after Auschwitz.

Cross-listed with: GER 532, JST 532

VSTUD 555: Visualizing Gender

3 Credits

This course analyzes how gender identities relate to the creation, use, and analysis of visual artifacts and bodily practices. Visual texts condition and are conditioned by intersectional embodiments of gender. In an attempt to understand and critically evaluate the role visual culture plays in our gendered lives as a dominant conduit of knowledge and identity production, this seminar examines visual processes and objects as they are informed and shaped by a nexus of gender, race, sexuality, class, nationality, and other forms of identity. The visualization of gendered forms of identity involves codes that produce bodies as signifiers of chaos, order, beauty, disease, nature, culture, evil, and virtue, including actions bisected according to binaries of masculinity and femininity. The seminar employs analytical approaches to these dynamics, including feminist, queer, and critical race theories of the visual as ways of interrogating a range of visual artifacts and bodily practices. After surveying key foundational texts, the course predominantly engages contemporary works and practices along complex gender matrices, including new directions in visual culture from the 1990s onward.

Cross-listed with: ENGL 555

VSTUD 556: Reading Film

3 Credits/Maximum of 12

A practical and historical approach to film theory and analysis. This seminar develops critical visual literacy by examining a range of practices in cinema study, with emphases on the relation of film to literature and the analysis of film meaning. The course asks how to read a film, and considers the multiple ways that films combine framing, movement, editing, narrative, character, and genre toward the production of culture, ideology, identity, desire, poetic imagery, and community. Students will explore a wide range of critical methods, and will view one to two films per week. Readings will range from novels to classic film theory, cultural studies, belles-lettres, film criticism, radical poetics, apparatus theory, media theory, and contemporary philosophy.

Cross-listed with: COMM 556, ENGL 556

VSTUD 557: Authors and Artists

3 Credits

This course explores formal and historical links between literature and art in modernist movements. "Ut pictura poesis" (like painting [is] poetry). This statement, originally articulated by the ancient Roman poet Horace, has been quoted and debated ever since. Links between art and literature have exerted a formative influence on the development of modern fiction and poetry as authors and artists in various avant-garde groupings collaborated and competed to generate modes of artistic expression appropriate to modernity. This course examines those interactions. Course objectives are to bring together for comparative examination: - formal or generic relationships between texts and images at particular historical moments. - issues of creative collaboration and

cross-pollination between writers and artists, which have been crucially important in the history of literature and poetry. - conceptions of creativity as these have been expressed by writers using the figure of the artist. This course allows students to explore the ways knowledge of literature and skills in critical reading can be rewardingly brought to bear on the visual arts, and to consider how visual art can illuminate the workings of literature both for individual readers and in the classroom.

Cross-listed with: ENGL 557

VSTUD 580: Comics and Graphic Novels

3 Credits

A survey of comics and graphic novels, primarily in English. This seminar provides a survey of the comics medium and an introduction to the academic field of Comics Studies. Students acquire facility in the structural and formal analysis of comics and sequential narrative, as well as knowledge of significant critical theories and methodologies within the field of Comics Studies. Assigned primary texts may be targeted to a particular genre, mode, historical period, or creator(s). While the course has a general focus on North America, students may also read texts from European, Japanese, and/or South American traditions (all of which will be taught in translation), not to exceed 25% of the course. Discussion of assigned texts will be situated within relevant scholarship and criticism (current and historical).

Cross-listed with: ENGL 580

VSTUD 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given infrequently to explore, in depth, a comparatively narrow subject.

VSTUD 897: Special Topics

1-9 Credits/Maximum of 9

Formal courses given infrequently to explore, in depth, a comparatively narrow subject.

Wildlife and Fisheries Science (WFS)

WFS 500: Professionalism in Natural Resources

3 Credits

Scholarly discussion and critique of skills important to professionalism of students in natural resources, wood products, and related science-based disciplines. W F S 500 Professionalism in Natural Resources (3) The course will give an in-depth coverage of issues and skills pertinent to the professionalism of graduate students in natural resources, wood products, or related science-based disciplines. Particular focus will be given to a discussion, critique, and development of communication skills (oral and written). In addition, a spectrum of pertinent topics and issues relevant to graduate students will be discussed in depth, ranging from the philosophy and land-grant institutions and to those important to the academic success of graduate students and their success in future careers. This course will be offered in fall semester each year.

Prerequisite: graduate student standing or permission of program

WFS 510: Design of Ecological Field Studies

2 Credits

Application of the scientific method and general principles of designing ecological field studies through discussion and critique of the primary literature.

WFS 542: Systematics

3 Credits

Principles and methods of classification, phylogeny, and speciation; taxonomic techniques; analysis of species; causal interpretation of animal diversity.

WFS 552: Systematics and Evolution of Fishes

3 Credits

Detailed study of the systematics, evolution, identification, and natural history of fishes.

Prerequisite: BIOL 421 , W F S452

WFS 560: Population Estimation and Modeling

4 Credits

Application of statistical models to estimating population parameters to test ecological theories. W F S 560 Population Estimation and Modeling (4)The purpose of this course is to impart a working knowledge of statistical methods for estimating fish and wildlife populations. Primary emphasis will be on methods of estimating population size, survival rates, and birth rates as they relate to testing hypotheses about population dynamics. Most of the course will focus on mark-recapture models for both open and closed populations, but other methods such as distance sampling and removal models that do not require marked animals will be studied.

Prerequisite: STAT 500 , STAT 501 or STAT 502

WFS 585: Applied Spatial Ecology

3 Credits/Maximum of 999

Students will develop skills in understanding and processing complex datasets while learning traditional and innovative methods for spatial data analysis. The purpose of this course is to assist researchers on methods for data management and analysis using a state-of-the-art statistical program after data has been collected in the field or for designing field experiments. The course focuses on wildlife/fisheries research, both basic and applied, that rely on large ecological datasets that provide unique opportunities to explicitly incorporate sources of spatial and temporal variability into understanding motivations for an organism's movements, resource selection, subpopulation structuring, or presence in a landscape. The impetus behind this course and resulting manual was to import data from spreadsheet software, import Geographical Information Systems (GIS) layers, and conduct statistical analysis of datasets all in a single software platform. In the past several decades, advancements in data acquisition have resulted in datasets often with thousands of records. Concurrent with these advancements in acquisition, methods of handling and manipulating large datasets, GIS capabilities, and methods of estimators for home range, movements, resource selection, and spatial epidemiology have increased dramatically.

WFS 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

Cross-listed with: FOR 590, SOILS 590

WFS 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

WFS 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

WFS 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

WFS 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

WFS 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Provides an opportunity for supervised and graded teaching experience in wildlife courses.

WFS 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

WFS 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No Description.

Women's Studies (WMNST)

WMNST 502: Global Perspectives on Feminism

3 Credits

Exploration of feminist issues in a global perspective, including debates in history, ethics, and political feminism.

WMNST 503: Feminist Media Studies

3 Credits

This course will explore key intellectual traditions, theoretical concepts, research methods, and axiological elements that inform research in feminist media studies. Course readings will be inter/trans/ disciplinary

so that students may gain a sense of the field of feminist media studies, its influences, and its possibilities. Readings and assignments may relate media studies with: feminist histories; transnational feminism; feminist political organizing and activism; queer studies; feminist approaches to masculinity, race, ethnicity, labor and production; sexual violence and harassment; relationships between feminist scholarship and other critical studies of culture, audience and reception studies, science and technology studies, rhetoric, political economy, and history.

Cross-listed with: COMM 503

WMNST 507: Feminist Theory

3 Credits

Development of feminist theory and its relationship to history in terms of critique of family, sexuality, and gender stratification.

WMNST 508: Feminist Methodology

3 Credits

The objective of this course is to examine feminist approaches to traditional research methodologies. The objective of this course is to examine feminist critiques of traditional research. The course will examine the animated and contentious debates among feminist scholars about what constitutes a feminist method. Although there is no single feminist method, this diverse academic community is searching for techniques consistent with their convictions as feminists. For this reason, the course will distinguish between methods, as tools for research, and methodology, as theory about the research process. The course reviews methods such as ethnography, interviewing, oral history, discourse analysis, visual analysis, and mixed method approaches. Cross Listings : GEOG 508 will be added as a cross-listed course.

Cross-listed with: GEOG 508

WMNST 509: Feminist Pedagogies

3 Credits

This interdisciplinary graduate seminar gives students an overview of the theoretical, epistemological, and methodological foundations of feminist pedagogy. We will examine theoretical frameworks of teaching and learning that promote justice and social change (i.e. praxis), as well as feminist pedagogical strategies that can be utilized within and beyond the classroom (i.e. practice). Students can expect to engage with various critical and liberatory pedagogies, pedagogies of identity and difference, and signature pedagogies. They will learn how feminist epistemologies shape (and are shaped by) ethical classroom practice, focusing on specific ways in which to cultivate and nurture feminist teaching and learning. In addition, students will also learn how to develop a syllabus and teaching philosophy.

WMNST 516: US Women's and Gender History

3 Credits

A critical analysis of gender and theories of gender in selected American historical contexts.

Cross-listed with: HIST 516

WMNST 518: Global Black Feminist Thought

3 Credits

This course will explore the historical background and various expressions of contemporary Black feminist thought around the globe.

WMNST 520: Gender and Nationalism

3 Credits

Impact of Western nationalism and colonialism on the organization of gender roles from the 18th century to the present.

WMNST 522: Gender and Sexuality

3 Credits

This course offers students an interdisciplinary overview of the complex topics of gender and sexuality. Employing various theoretical and disciplinary perspectives including feminist and queer theory, historical and sociological perspectives, visual culture, and post-colonial discourse, this course gives students a broad understanding of key historical and contemporary issues in the arena of gender and sexuality. This course engages the following themes: gender and sexual identities; the intersectionality of gender, sexuality, race, and class; discourses of heteronormativity & homonormativity; the body, body politics, and bodily violence; contemporary movements for gender and sexual justice; racial, gender and sexual politics; performances and representations of gender and sexuality; health and medicalization; global LGBTQA human rights issues; the (re)production of gender and sexual difference; labors of gender and sexuality; and the relationship between gender, sexuality and the State. Students in this course will develop a keen understanding of how these themes operate in the discourse of gender and sexuality. Throughout this course students will examine a variety of diverse texts 'theoretical, historical ethnographic, literary, visual, and sonic' to gain a comprehensive introduction to the topic of gender and sexuality. This graduate seminar emphasizes discussion, writing, and research.

WMNST 523: Seminar in Work-Life Dilemmas, Practices, and Policies

3 Credits

The course will provide students with an analytic framework for understanding how social inequalities in race, class, and gender shape experiences in families and the workplace. WMNST (HRER) 523 Seminar in Work-Life Dilemmas, Practices, and Policies (3) This course investigates many of the invisible challenges people face in the 21st century labor market including: what happens when a worker's child is sick; whether mothers are discriminated against in the labor market; what happens to men at work when they have children; whether a person's health is influenced by their work; and if the division of labor at home benefits some people more than others. This course will provide answers to these questions and more through an in-depth investigation of the institutions that structure work-family life in 21st century America. First, the class will consider how work and families have changed in the last 50 years. Second, the students will investigate how inequalities based on gender, race, class, and family structure manifest at work. Third, the course will investigate how work responsibilities impact home life and how this differs according to race, gender, class and family structure. Finally, the course will ask what solutions may fix some of today's most pressing work-life dilemmas.

Cross-Listed

WMNST 525: Trans of Color Critique

3 Credits

A history of transgender struggle has fomented intellectual formations that interrogate racial and gendered logics and proffer alternative structures of engagement, but commitment to any conceptualization of trans critique has often fallen back on assumptive ascriptions to non-racial analysis. Gathered at the concomitant study of race, gender, sexuality, class, and socio-spatiality, Trans of Color Critique provides an opportunity to (re)consider the analytical and material possibilities and tensions tendered by the articulation of transgender and non-white. Engaging with trans (and queer) of color theory as a particular approach to the political and as its own mode of knowledge production, we will not only take up the mutual constitution of race and gender, but center how whiteness has come to construct the burgeoning field of trans studies. In this graduate seminar we will consider the ways in which these multiply marginalized knowledges aim a critical challenge at our Western knowledge traditions. The course considers how race as a modality of analysis and trans of color critique as a praxis can in turn amplify, extend, and complicate the framework and analytical interventions offered by trans studies. Rather than attempt to be exhaustive, we will focus on the urgent interventions offered by trans of color critical theory, especially as it relates to foundational disruptions of Western epistemologies, medicalization, humanism, movement and displacement, decolonial critique, carcerality, violence and death, and futurity.

Recommended Preparation: Prior coursework in Women's, Gender, and Sexuality Studies is recommended as well as familiarity with critical cultural and social theory.

Cross-listed with: AFAM 525

WMNST 536: Gender and Science

3 Credits

Studies the foundations of feminist science studies as applied to biocultural practices of gender, biology, and reproductive technologies. WMNST 536 Gender and Science (3) This course explores the productive intersection between gender and science. Students will learn to examine scientific culture, technological developments, and popular narratives of science through the concepts and methodologies of feminist science studies. A portion of the course will be devoted to the foundations of science studies, including critical examinations of the production of scientific knowledge and methodologies for examining science as culture. Students will use concepts from feminist science studies to resituate the possibilities of objectivity, materiality, and practice for science. Students will also consider the implications of scientific institutions, practices, and technologies for sex and gender. The course will take up both historical and contemporary technoscientific practices as case studies, including biotechnologies, reproductive technologies, bioart, animal husbandry and reproduction, eugenics, and risk assessment, management and mitigation.

WMNST 537: Gender, Sexuality and Islam in Africa: Exploring Contemporary Feminist Scholarship

3 Credits

A course about discourses of sexuality and gender in studies of Islam in Africa, with South Africa as a case study.

Cross-listed with: AFR 537

WMNST 538: Feminist Philosophy Seminar

3 Credits

Critically examines feminist approaches to ethics, epistemology, philosophy of science, metaphysics, social/political philosophy, and the history of philosophy. PHIL (WMNST) 538 Feminist Philosophy Seminar (3) This course aims to give students an understanding of the philosophical concepts and problems of feminist philosophy. The course will focus on major topics, such as the history of philosophy, ethics, social/political philosophy, epistemology and philosophy of science, and metaphysics, and figures within 20th century feminist philosophy with the concurrent goal of bringing them to bear on contemporary issues involving gender's relationship to race, sexuality, class, disability, nationality and age. This course builds upon PHIL 438 Feminist Philosophy and counts towards the requirements of the dual title degree in Philosophy and Women's Studies. Evaluation methods include preparation for and participation in class meetings, two short discussion papers, and a final term paper. The course will be offered at least once every four semesters with an enrollment goal of 20. Specific course content will vary with instructor.

Cross-listed with: PHIL 538

WMNST 542: Girls' Cultures and Popular Cultures

3 Credits

This seminar explores educational implications in popular texts created for and by girls across time and cultures. CI (WMNST) 542 Girls' Cultures and Popular Cultures (3) The study of girls and their relationship with popular culture lies within the interdisciplinary field of Girlhood Studies which draws on established areas of Women's Studies, Children's/ Childhood studies, Cultural Studies and Educational Studies. This seminar explores girls cultures in different textual and material forms including books, toys, magazines, and new media. Students will employ feminist cultural theories to compare historical and contemporary girls cultures in relation to educational research and practice. This will provide a framework to locate girls at the center of research and action in order for graduate students to engage in methodologies that are not simply about girls but "for" "with" and "by" girls. Key topics include the misperception of girls (popular) culture as only a contemporary phenomenon, the role of girls as consumers plus producers of culture, and recurrent issues in girls cultures such as sexualization and hyperfemininity.

Cross-listed with: CI 542

WMNST 550: African Feminisms

3 Credits

African feminisms are deeply rooted in the continent's rich historical traditions and diverse cultural contexts. In this interdisciplinary graduate seminar, students will become familiar with the theoretical frameworks that guide African feminist scholarship, as well as the activist histories from which they emerged. This course will consider the epistemological foundations of African feminist thought and how they differ from feminisms in other parts of the world. This course will also examine key areas of conjuncture - how African feminisms map on to larger transnational movements. Particular emphasis will be placed on the fluidity of African gender systems, the ways in which African women have negotiated politics, religion, militarism, sexuality, and violence, and the role of creativity, art, and beauty in nurturing and sustaining activist

momentum. Students in the course can expect to engage with a number of different types of texts: documentaries, feature films, memoirs, novels, newspapers, scholarly books, and articles.

Cross-listed with: AFR 550

WMNST 594: Research Topics

1-15 Credits/Maximum of 15

Supervised student activities on research projects identified on an individual or small-group basis.

WMNST 595: Internship

1-18 Credits/Maximum of 18

Supervised off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

WMNST 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

WMNST 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

WMNST 597G: **SPECIAL TOPICS**

3 Credits

WMNST 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Supervised experience in teaching and orientation to other selected aspects of the profession at The Pennsylvania State University.

Wood Products (WP)

WP 537: International Wood Products Marketing and Trade

3 Credits

Strategic analysis, environmental scanning, international trade policy implications, determinants of competitive strategy for firms, industries, and nations.

Prerequisite: W P 437W

WP 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

WP 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

WP 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

WP 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

Provides an opportunity for supervised and graded teaching experience in forest products courses.

WP 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

Workforce Education and Development (WFED)

WFED 501: Scholarly Writing for Workforce Education and Development

3 Credits

This course is grounded in the current research literature, theoretical frameworks, analysis, and methodologies within the discipline of Workforce Education and Development. Within this course students will engage in synthesis of knowledge and analytical work. The objective of this course is to contribute to the student's ability to expand the frontiers of knowledge, and produce creative scholarly writing products with a particular focus on scholarship within the field of Workforce Education and Development. The course content includes: (1) Research literature and theoretical frameworks in Workforce Education and Development; (2) The annotated bibliography foundation; (3) Analysis and methodologies within Workforce Education and Development; (4) The literature review process; (5) Developing positive writing habits; (6) Writing for publication in Workforce Education and Development; (7) Research presentation formats; and (8) Enhancement of Scholarship for the future.

WFED 508: Workforce Education Management

3 Credits

Introduction to theories and concepts of managing workforce education programs in the public and private sector.

WFED 518: Curriculum and Instructional Leadership for Workforce Education

3 Credits

Study of topics related to curriculum and instructional leadership in workforce education in the public and private sectors.

Prerequisite: 3 years of professional experience in vocational education

WFED 528: Fiscal and Facilities Management for Vocational Administrators

3 Credits

Sources of revenue, budget preparation, purchasing, and the management of physical facilities in vocational education.

Prerequisite: 3 years of professional experience in vocational education

WFED 529: Ethical Issues in Workforce Education and Development

3 Credits

A study of ethical issues in workforce education environments in industry and education.

WFED 538: Administering Personnel Services in Vocational Education

3 Credits

Planning and implementing staff development activities, student guidance services, admissions, student organizations, and placement.

Prerequisite: 3 years of professional experience in vocational education

WFED 540: Data Analysis in Workforce Education and Development

3 Credits

Provides opportunities to acquire and practice skills in descriptive and inferential statistics.

WFED 543: Evaluation of Investments in Workforce Education and Development

3 Credits

Use of labor supply models to evaluate investments in workforce education and development.

WFED 544: Analysis of Policies for Workforce Education and Development

3 Credits

Explores models and methods for analyzing policies for workforce education.

Prerequisite: I ED 540 , WF ED550

WFED 546: Work Based Education

3 Credits

Discussion of legislation and educational requirements for education based at the worksite including cooperative education, youth apprenticeship, and apprenticeship programs.

Prerequisite: WF ED441

WFED 550: Research in Workforce Education

3 Credits

Research techniques in workforce education.

WFED 560: Historical and Philosophical Foundations of Workforce Education

3 Credits

An investigation of historical, philosophical, and professional foundations of workforce education.

WFED 572: Foundations in Organization Development and Change

3 Credits

Development of major concepts, skills and techniques required by workplace learning professionals to support and facilitate organization change.

WFED 573: Needs Assessment for Workforce Development Professionals

3 Credits

Acquire skills to identify training and development needs, distinguish problems with management versus training solutions, develop and evaluate training solutions. WF ED 573 Needs Assessment for Workforce Development Professionals (3) WF ED 573 is designed for workforce development professionals to familiarize them with the models, concepts, and techniques for designing, implementing, and analyzing the results of training needs assessments in organizations. After successfully completing this course, they will have the necessary skills and competencies to identify human performance problems, distinguish between training and non-training plans of action, and design and develop appropriate plans of action in response to human performance problems.

WFED 578: Process Consultation in Organization Development

3 Credits

This course provides a foundation in process consultation. Process refers to how groups interact and how people get along.

WFED 582: Assessing Data: Organizational Diagnosis

3 Credits

This course familiarizes students with approaches to assessing and feeding back data in organization development (OD) and consulting services. WF ED 582 Assessing Data: Organizational Diagnosis (3) This course familiarizes students with approaches to assessing and feeding back data in organization development (OD) and consulting services. It helps students to develop the specialized competencies essential to diagnosing organizations for change efforts/interventions. Students in the course will learn various ways by which to define and conceptualize assessment, feedback, and diagnosis for OD and consulting efforts. Students will learn how to distinguish between the unique approaches to organizational diagnosis used by OD consultants and by management consultants to detect the underlying root causes of problems rather than the mere symptoms of such problems. OD consultants who work inside organizations (internal consultants) may face unique challenges in organizational diagnosis that differ from those challenges faced by consultants who are brought in from outside (external consultants), and this course will explore those challenges faced by each type of consultant and how those consultants may overcome those special challenges. The course will encourage students to identify the consulting competencies that OD consultants need to diagnose organizational problems, and the students will be invited to compare themselves to those competencies so that they will know what special skills

they need to develop to be effective organizational diagnosticians and how to develop those skills. The course reviews the important elements necessary in establishing a strategic diagnostic plan for OD, implementing it, and evaluating the assessment and feedback strategy. Students will learn how to demonstrate the skills essential to separating symptoms (presenting problems) from underlying root causes during initial meetings and contacts with prospective OD sponsors and clients. Additionally, the course will examine how to prepare assessment and feedback protocols and reports for OD and change management interventions. Finally, the course will summarize current thinking and research on organizational diagnosis, assessment and feedback methods as well as ethical issues affecting organizational diagnosis and OD assessment and feedback.

WFED 585: Appraising Organization Change and Development and Consulting

3 Credits

This course familiarizes students with approaches to evaluating organization development (OD) and consulting services.

WFED 588: Platform Skills for Human Resource Development Professionals

3 Credits

Platform skills focuses on theory and practice related to delivering well-crafted and effective training presentations.

WFED 590: Industrial Training Professional Seminars

1 Credits

Study of special topics relating to problems, practices, methodologies and special competency needs in industrial training.

WFED 595: **SPECIAL TOPICS**

1-15 Credits/Maximum of 15

WFED 595A: Field Based Project for Workforce Development Professionals

2-5 Credits/Maximum of 5

WF ED 595A Field Based Project for Workforce Development Professionals (2-5 per semester/maximum of 5) WF ED 595A is a field based experiential learning course for students to identify a training and/or organization development project in business, industry, or government and carry out contract problem analysis and resolutions.

WFED 595B: Workforce Education Administrative Internship

2-15 Credits/Maximum of 15

Supervised study with an administrator or researcher at a cooperating school, state governmental agency, or research institution.

WFED 595C: Internship in Cooperative Vocational Education

1-10 Credits/Maximum of 10

Validation of teaching and co-op coordinator competencies learned in prerequisite courses during interaction with professional staff while functioning under the supervision of a certified cooperative coordinator.

Prerequisite: WF ED441 , WF ED442

WFED 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.

WFED 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topic or special interest subject which may be offered infrequently.

WFED 597A: **SPECIAL TOPICS**

3 Credits

WFED 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

WFED 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

WFED 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 6

An opportunity for graduate students to teach a college level course under the supervision of an experience professor.

WFED 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

WFED 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

WFED 806: Program and Facilities Management for Work Force Development Professionals

3 Credits

This course examines advanced learning laboratory organization and management processes to facilitate learning and skill development in a safe environment. WF ED 806 Program and Facilities Management for Work Force Development Professionals (3) Program and Facilities Management for Workforce Development Professionals thoroughly examines the two categories of managing an educational laboratory, which include the physical operations and program management responsibilities. The physical operations deal with the actual physical facility including the building, tools, equipment, and maintenance. The program management aspect deals with the safety organization and the functionality of the environment. This course will present advanced principles of managing facilities and focus on the safety and functionality aspects that are imperative in the development of

successful learning environments. Additionally, students will explore advanced concepts of occupational safety and health as defined by the U.S. Department of Labor (i.e., OSHA & NIOSH), which are vital to every technical program and workplace. Emphasis will be placed on the individual laboratory and instructional strategies regarding safety within the educational environment and greater world-of-work. Throughout the course students will read and reflect upon practical, theoretical and research oriented literature about occupational education programs and facilities management, laboratory supervision and instruction as well as on occupational safety and health. At the end of the semester, students will design and showcase a comprehensive safety implementation plan, which promotes successful management, supervision and instruction.

WFED 807: Career and Technical Student Organizations (CTSOs)

3 Credits

This course examines principles and practices of Career and Technical Student Organizations to promote enhanced learning and skills development. WF ED 807 Career and Technical Student Organizations (CTSOs) (3) This course examines principles and practices of organizing, managing and advising Career and Technical Student Organizations (CTSOs) to promote enhanced learning and skill development within Career and Technical Education (CTE). Emphasis is placed on the integral relationship between CTSOs and CTE, as well as advisor responsibilities. Students will learn specific procedures for establishing programs of work; incorporating local, state and national events and activities into career and technical curriculum and instruction; advisor roles and ethical imperatives; financial operations; integration of academics; public relations; and student recruitment and retention.

WFED 808: Assessment Techniques in Workforce Education

3 Credits

This course examines advanced assessment techniques associated with learning in an integrated competency-based Career and Technical Education (CTE) program. This course examines advanced assessment techniques as well as recording and reporting procedures to promote enhanced learning and skill development within Career and Technical Education (CTE). Emphasis is placed on the integral relationship between competency-based learning and CTE, as well as instructor responsibilities. This course is designed to provide students with an opportunity to develop the competencies needed to facilitate their implementation and management of a classroom- and laboratory-based assessment program.

WFED 852: Global Talent Development

3 Credits

Global Talent Development (GTD) is the systematic process of developing employees to be in the right place at the right time to do the right things to achieve the right results in ways that align with business strategy, organizational values, and organizational ethics. The Global Talent Development Leader is the person in the organization who facilitates this process. Part of a larger talent management effort, GTD emphasizes growing the organization's internal talent to meet present and future needs.

WFED 865: Implementing Training as an Organization Development Intervention

3 Credits

In this course, students will be asked to do more than accept the conventional wisdom of organization development and change. Students will look at the standard approaches and then beyond them to examine critically the processes associated with planning, developing, and implementing training and development programs in the context of the whole organization. Students will focus on how to create changes that take into account the individuals who comprise the organization at the same time that the changes improve the organization's overall effectiveness. A key point of emphasis will be the connection between the models, theories, and strategies and the students' workplaces and their professional practices. Students will be encouraged to share stories about their experiences - both past and current - that illustrate or raise questions about concepts discussed in the course

WFED 870: Whole System Change for Workforce Professionals

3 Credits

The Whole System Change Approach is a change model for transforming any business into a thriving organization by aligning internal systems with external forces and engaging every person in an organization. This course provides the background and theory for building a Whole System Change Approach that is sustainable and strategic. The approach is intended to alter the relationship between an organization and its environment, and to affect outcomes at the organization level, including revenue, profitability, and culture. WFED 870 (Whole System Change) is designed to familiarize students with the Whole System Change Approach, including models, concepts, techniques for designing large-scale changes, implementing, and evaluating results of the whole system change intervention in organizations.

WFED 875: Current Policy and Practices in Organization Development

3 Credits

The purpose of this course is to explore current policy and practices in contemporary organizations. This course is designed to familiarize students with recent trends, practices, theories, research, and cases. This knowledge will prepare students to become competitive OD/HRD professionals.

WFED 876: Facilitating Organization Development and Change Through Technology

3 Credits

This course aims to equip OD/HRD professionals with the technological acumen necessary for their consulting practice and work efficiency. Emerging topics such as security and big data have become integral to technology usage in the workplace. In this course, students will learn about such trends and develop an understanding of how to intervene in organization processes to improve performance by utilizing technological tactics and software programs to gather, visualize, and present data to client organizations. Other tools and technologies that enhance knowledge management, team-building, and project management will also be explored.

WFED 877: Training-Group Seminar

1 Credits

This course familiarizes students with self as an instrument of change and sensitizes individuals to their role in group dynamics.

WFED 880: Facilitating Groups and Teams

3 Credits

This course provides students with necessary skills to facilitate small groups and teams. WF ED 880 Facilitating Groups and Teams (3) This course acquaints students with the role of facilitator and provides a comprehensive introduction to facilitation. Small group facilitators focus on group process and help groups work collectively to accomplish common goals. The course will build student skills in facilitation, acquaint students with the competencies of facilitation, review the role of facilitation in small group situations, and explore current research and practice in small group/team facilitation. The course examines theoretical and practical perspectives of facilitation and provides opportunities to practice facilitation techniques and build facilitation skills.

WFED 881: Marketing Organization Development

3 Credits

This course familiarizes students with the unique issues in marketing organization development (OD) and OD consulting services.

WFED 883: Organization Change and Development Interventions

3 Credits

This course focuses on organization change and development interventions, where an intervention means a change effort.

WFED 884: Appreciative Inquiry

3 Credits

This course provides a foundation in the theories, principles and techniques of Appreciative Inquiry (AI). WFED 884 Appreciative Inquiry (3) This course provides a foundation in the theories, principles and techniques of Appreciative Inquiry (AI), sometimes called "positive change theory" or "positive organizational scholarship." Students will build practical competencies necessary to carry out various AI interventions based on the theories and techniques of organization development and change management. The course will teach students how to define Appreciative Inquiry (AI) and distinguish it from alternative approaches to organization development (OD) and change management (CM). The course describes how AI relates to training and development and other performance improvement interventions, summarizes the history of AI, explains important theories of organizations and describes how small group and large group change interventions using AI differ from training interventions, describes each step in a common AI model and explain how it is applied. The course also reviews ethical issues affecting AI, identifies and summarizes future organizational trends affecting AI, and describes what they might mean for practitioners who use AI.

WFED 885: Appreciative Inquiry Coaching**3 Credits**

Appreciative inquiry has been called the next generation of organization development. Appreciative inquiry is a strength-based approach to change methodology, as well as a paradigm of thought, a worldview, and a way of being in the world. For these reasons, appreciative inquiry coaching is a timely and important topic. The knowledge and skills related to appreciative inquiry coaching gained during this course will prepare students to become well-rounded OD/HRD professionals.

WFED 886: Laboratory in Organization Change and Development**3 Credits**

Students will work in teams to carry out an OD intervention in a field setting.

WFED 888: Developing Appreciative Leaders**3 Credits**

This course provides an in-depth look of appreciative leadership. Students will learn the story of appreciative leadership through assigned readings, discussions, and videos, as well as assignments that allow them to analyze and practice appreciative learning. They will also have the opportunity to practice applying class concepts to actual workplace situations and to develop their own leadership styles

WFED 895: Internship**1-18 Credits/Maximum of 18**

Supervised, professionally oriented, off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.

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